



COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

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MEMORANDUM

TO: State Water Control Board Members

FROM: Jutta Schneider, Water Planning Division Director

SUBJECT: **Final Adoption of Water Quality Standards Regulation Amendments (9 VAC 25-260) – Section 155: Freshwater Ammonia Criteria**

DATE: November 20, 2018

EXECUTIVE SUMMARY

Staff will ask the Board to adopt proposed amendments to the Virginia Water Quality Standards Regulation, 9 VAC 25-260-155, specifically freshwater ammonia criteria for the protection of aquatic life. This recommendation is based on:

- Review of final EPA criteria recommendations issued in 2013 and technical support information,
- Comments received on the proposed amendments during two public review/hearing periods (Sept. 18 – Dec. 8, 2017, and Aug. 6 - Oct. 5, 2018),
- Input received from a Regulatory Advisory Panel over the course of this rulemaking (member listing provided in Attachment 1), and
- A Virginia Code mandate enacted by the 2018 General Assembly requiring that the Board include in such adoption a Phased Implementation Program (PIP) consistent with the federal Clean Water Act.

BACKGROUND

The water quality standards are the cornerstone for water quality protection and restoration programs at DEQ. For example, these standards are used to set pollution limits in discharge permits and evaluate the quality of surface waters statewide. Water quality standards define the goals for healthy waters by designating their uses, setting water quality conditions that will protect those uses and establishing anti-degradation provisions to safeguard high quality waters. They protect water quality so rivers, lakes and other waterbodies can be sources of water supplies; support recreational, agricultural, and industrial activities, among others; promote the growth of fish and shellfish that are suitable for human consumption; and, protect aquatic life and water-dependent wildlife.

Both the Clean Water Act and State Water Control Law require that the Board review Virginia's water quality standards every three years for the purposes of revising and updating to reflect changes in law, technology and scientific information. The goal is to provide the citizens of the Commonwealth with a

technical regulation that is protective of water quality in surface waters, incorporates recent scientific information, reflects agency procedures and is reasonable and practical.

Consideration of amendments to the freshwater ammonia criteria began under the most recent Triennial Review that was started in 2013, along with numerous other revisions for parameters including manganese, copper, several waterbody reclassifications, bacteria, cadmium, and 94 human health criteria. The Board previously approved amendments for these other parameters at their meetings on 1/14/16 and 8/21/18. The ammonia criteria amendments were separated from the original Triennial Review with the Board's approval on 1/14/16 (along with bacteria, cadmium and 94 human health criteria) to allow additional time to consider and address significant public comments received or more recent criteria recommendations from the Environmental Protection Agency. A second deferral on the ammonia criteria was approved by the Board at their 8/21/18 meeting to allow DEQ to incorporate the General Assembly's mandate that a Phased Implementation Program accompany the adoption of the amended criteria. The full text of the proposed technical amendments to the freshwater ammonia criteria is provided in Attachment 2. The full text of the proposed Phased Implementation Program is provided in Attachment 3.

SUBSTANCE OF PROPOSED AMENDMENTS

In August 2013, the Environmental Protection Agency (EPA) published updated nationally recommended freshwater ammonia criteria for the protection of aquatic life. Like the current criteria, the proposed criteria are calculated as a function of temperature and pH and account for the presence or absence of trout and early life stages of fish. In general, the toxic effects of ammonia on aquatic life become more pronounced with increasing pH and temperature.

Based on the most recent scientific studies, the recalculated ammonia criteria now incorporate toxicity data for freshwater mussels and snails, which are the most sensitive organisms in the recalculation data base. The new criteria are about twice as stringent as the existing criteria primarily because more recent toxicity data show that mussels and snails (including endangered species) are very sensitive to ammonia and the current ammonia criteria do not provide sufficient protection for these species. Site specific options to calculate criteria omitting mussel toxicity data are proposed to be used in waters where a demonstration has been made that mussels are absent; however, consultation with U.S. Fish and Wildlife Service and the Virginia Department of Game and Inland Fisheries indicate freshwater mussels should be considered ubiquitous in Virginia and likely to be present in any perennial waterbody.

Table 1. EPA's 2013 Final Freshwater Aquatic Life Criteria for Ammonia

CRITERIA* (Assumed pH = 7.0; T = 20° C)	CONCENTRATION (mg/L total ammonia nitrogen)
Acute (1-hour average)	17
Chronic (30-day rolling average)	1.9**

* **Criteria Frequency:** Not to be exceeded more than once in 3 years on average.

** Not to exceed 2.5 times the chronic concentration as a **4-day average** within 30 days.

Compared to the current criteria, which were based on EPA recommendations issued in 1999, at pH 7 and 20°C the 2013 acute criterion magnitude is 1.4-fold lower than the current acute criterion. At this pH and temperature, the 2013 chronic criterion magnitude is 2.4-fold lower than the current chronic

criterion. The decreases in criteria magnitudes reflect the inclusion of the new toxicity data discussed above.

Public Comment and DEQ Response

A. During the **first public review period**, which closed December 8, 2017, the following comments were received on the proposed ammonia criteria amendments:

1. Commenter: Chesapeake Bay Foundation; expressed support for the proposed revisions with a 10-year compliance schedule for facilities that cannot meet permit limits; did not support allowing schedules to extend beyond this period.

DEQ's Response: *Acknowledge CBF's support for the proposed revisions.*

2. Commenter: U.S. Environmental Protection Agency; stated that DEQ should ensure the proposal is consistent with recommendations regarding duration and frequency of exceedance, specifying that the 4-day average of ammonia concentration (not to exceed 2.5 times the chronic criterion in a 30-day period) be included in the proposal.

DEQ's Response: *DEQ acknowledges the EPA 2013 recommendation for the 4-day average chronic criterion, but did not originally include this criterion in the proposed amendments. At that time, DEQ was relying on EPA's 1999 implementation guidance which provided for the allowance that a 30Q10 design flow when calculating steady state waste load allocations for dischargers should also be as protective as 2.5 times any 4-day average (Federal Register, FRL-6513-6 December 22, 1999-Implementation Guidance). "30Q10" means the lowest flow in the receiving stream, averaged over a period of 30 consecutive days that can be statistically expected to occur once every 10 climatic years. This factor was adopted into the Board's 2001 rulemaking (approved by EPA) for the ammonia criteria as footnote "6" to Section 140.B. EPA's guidance for the 2013 criteria is silent on this matter; therefore, DEQ assumed that the current wording in the Water Quality Standards Regulation was still valid and sufficient. EPA has since pointed out that the provision for use of the 30Q10 is in the implementation section of the 1999 guidance, not in the actual criteria recommendations. The proposed inclusion now of the 4-day average criterion is addressed in the Comment/Response section below, related to the most recent public comment period (Aug. 6 - Oct. 5, 2018).*

3. Commenters: Amherst Co. Service Authority (S.A.), August Co. S.A., Bath Co. S.A., Town of Culpeper, Frederick Water, City of Fredericksburg, Goochland Co. Dept. of Public Utilities, Halifax Co. S.A., Hampton Roads Sanitation District, Hanover Co., Harrisonburg-Rockingham Regional S.A., Henry Co. Public S.A., Town of Hillsville, Hopewell Water Renewal, Lee Co. Public S.A., Loudoun Water, Louisa Co. Water Authority, City of Norton, Pepper's Ferry Regional Wastewater Treatment Authority, Rapidan S.A., City of Richmond, Town of Tappahannock, Tazewell Co. Public S.A., Upper Occoquan S.A., Virginia Coal and Energy Alliance, Inc., Virginia Association of Municipal Wastewater Agencies, Virginia Manufacturers Association, Virginia Rural Water Association, Virginia Water and Waste Authorities Association, Warm Spring Sanitation Commission, Wise Co. Board of Supervisors, Wythe Co. Public S.A.

Commenters expressed concern over the increased costs they predict will be incurred by permitted facilities due to the adoption of the updated ammonia criteria that may result in more

stringent discharge permit limits. They requested that DEQ consider a long-term phased implementation plan that works in conjunction with the implementation of other nitrogen-based requirements (e.g., Chesapeake Bay TMDL), with assistance provided through the Water Quality Improvement Fund. Commenters also requested that DEQ make specific allowances for permit limits (e.g., the use of a 50th percentile pH value rather than 90th percentile pH value). Some commenters also request a delay in the adoption of the new criteria to allow for more refined planning.

DEQ's Response: *The agency realizes there is potential for economic impacts to treatment facilities. This issue is addressed in the Comment/Response section below, related to the most recent public comment period (Aug. 6 - Oct. 5, 2018).*

- B. During the **second public review period**, which closed October 5, 2018, the following comments were received on the proposed ammonia criteria amendments. DEQ received 47 sets of comments from local governments, wastewater authorities, industrial dischargers, associations and representative organizations, one environmental group, one citizen, and the EPA (see Attachment 4 for the full list of commenters). Most of the localities, Service Authorities, and Public Utilities operating municipal sewage treatment works provided very similar comments based upon recommendations developed by the Virginia Association of Municipal Wastewater Agencies (VAMWA) and were submitted using virtually the same format.

1. Shared Comments:

- a. The risk of financial hardship is extreme, particularly for small municipal wastewater systems, including many serving rural areas of the Commonwealth. Most of the commenters reference costs calculated by an engineering firm retained by VAMWA. Those cost estimates (in 2014 dollars) are \$512 million in capital costs plus recurring annual operation and maintenance costs of \$34 million as their best estimate of this impact on Virginia localities, wastewater authorities and utility ratepayers.

DEQ's Response: *DEQ acknowledges the potential fiscal impact on dischargers not currently controlling ammonia in their discharge and accepted the VAMWA cost estimates as representative. It was for this reason the original criteria amendments were proposed to include provisions for extended compliance schedules (beyond the term of a permit) based on demonstrated need to give time to secure necessary funding, plan, design and construct needed retrofits and cost-effectively address multi-purpose projects. This "strawman" language has now been replaced with the provisions for the Phased Implementation Program enacted by the 2018 General Assembly.*

- b. Agree with the goal of providing appropriate protection for snails and mussels (the most sensitive species used in ammonia toxicity calculations) but believe spending on additional protection for those species should be considered in the context of the broader public interest including important societal needs, rather than mandating it, which forces snail and mussel protection as a priority over discretionary public spending. Costs for compliance with the more stringent criteria may result in unmet legitimate environmental and non-environmental public needs such as schools and other locality infrastructure due to limited financial resources.

DEQ's Response: *Both the federal Clean Water Act and Virginia's State Water Control Law mandate protection of designated uses, including aquatic life. This mandate is not given in the context of considering all other possible public interests and societal needs, but inclusion of the PIP in the ammonia criteria amendments is intended to lessen the impact on affected dischargers while achieving the requirement to protect aquatic life.*

- c. Most of the commenters provided information on their wastewater systems. Three of the localities are currently in various stages of progress to upgrade Combined Sewer Overflow (CSO) systems (Cities of Alexandria, Lynchburg, and Richmond) and they state that considerable financial resources have been, and continue to be spent, to ensure those projects are completed.

DEQ's Response – *DEQ acknowledges the efforts made by permitted facilities to control discharge of pollutants of all types to Virginia's waters.*

- d. The majority of commenters recommended that DEQ include the Phased Implementation Plan (PIP) in the regulation with the added extension of 6 months for each facility tier. This would change the proposed 6, 18 and 30 months for Tiers 1, 2, and 3 respectively to 12, 24 and 36 months. It is also suggested that the design flow for the first tier of facilities should be changed from 1.0 MGD and greater design capacity (DEQ's proposal) to 5.0 MGD and greater capacity. They state owners of facilities greater than 5.0 MGD would likely be in a better situation to understand and prepare for the application process, whereas owners of facilities below 5.0 MGD (smaller localities or authorities) will require more DEQ outreach, assistance and lead time to prepare preliminary engineering analyses and the information required in those analyses, and in determining the appropriate criteria compliance schedules. Similarly, the second tier should be increased from 0.1 MGD to 0.5 MGD, and the third tier from less than 0.1 MGD to less than 0.5 MGD.

DEQ's Response – *The ammonia criteria amendments that will be recommended to the State Water Control Board for adoption include the PIP. In response to the comments received, staff has proposed changes to the classes of permittees outlined in Part G.1 and extended the effective dates of the criteria by 6 months for each of the three tiers.*

- e. Urge DEQ to use all available implementation procedures and practices to minimize the impacts on wastewater facilities, including procedures from other states that have been previously approved by EPA and other recommendations by VAMWA that are not prohibited by federal statute or regulation and reduce layers of conservatism in the permitting process.

DEQ's Response – *DEQ is evaluating the factors and assumptions used in deriving ammonia permit limits and will make changes that can be reasonably accommodated and scientifically justified in order to provide additional relief to permittees. These changes will not be included in the Water Quality Standards Regulation, but will be addressed in agency permitting guidance with an opportunity for input from interested stakeholders.*

- 2. Commenter: Town of Keysville; stated that compliance with more stringent ammonia criteria is too expensive and they cannot afford to do any plant improvements to increase ammonia

removal. They understand the intent of the proposed regulation; however, the increased cost to already struggling budgets to small utilities such as theirs is neither fair nor feasible.

DEQ's Response - *The proposed amendments provide the option of utilizing compliance schedules specific to ammonia that can extend longer than 5 years. Language was developed with input from Regulatory Advisory Panel participants to amend section 9VAC25-260-155 (ammonia criteria) to address permit compliance schedules for ammonia limits to allow for the time necessary to secure financial resources for facility upgrades needed for those facilities to be compliant with newer, more stringent discharge limits. Any additional modification to permitting practices for determination of discharge limits for ammonia would be addressed through permitting guidance. On the issue of potential financial stress caused by implementing the revised ammonia criteria, the 2018 General Assembly revised the eligibility provisions of the Water Quality Improvement Fund to specifically identify "cost effective technologies to reduce loads of...nitrogen-containing ammonia" to the list of project types eligible for grant funding. Further, DEQ's Clean Water Revolving Loan Fund Program makes available low interest loans for plant retrofits, sometimes with zero-interest (and on occasion "principal forgiveness") in cases of severe fiscal stress on the recipient.*

3. Commenter: VA Manufacturers Association; stated that the factors for demonstrating the need for an extended compliance schedule do not adequately account for industrial dischargers. DEQ should include a specific process for industrial dischargers to assert and receive protection against the public disclosure of confidential business information. The time frame for issuing permits incorporating the new criteria (as water quality-based effluent limits) is too inflexible. Request that DEQ revise 9 VAC 25-260-155.G.3.a, to add the following factor ("v"): "For industrial dischargers, the technological or economic practicability of complying with the ammonia criteria, based on industry or facility-specific information".

DEQ's Response - *DEQ acknowledges that the language included in State Code and the proposed Regulation applies more directly to municipal facilities. DEQ has modified Parts G.3.a.i., G.3.b.ii, and G.3.b.iv to clarify that these provisions are also available to industrial discharges.*

The intent of the proposed PIP is that it be applicable to all VPDES permits issued pursuant to 9VAC25-31, Virginia Pollutant Discharge Elimination System (VPDES) Permit Regulation. While both major and minor industrial facilities are referenced in the PIP, DEQ agrees that some clarifying revisions (underlined below) should be made to the proposal to better accommodate industrial dischargers.

- *Item 3.a.i. will now read: "The relative priority of ammonia criteria and other water quality and water infrastructure needs of the local community or permittee". (This change could cover any non-municipal treatment plant, such as industrials, privately-owned treatment works, or commercial facilities).*
- *Item 3.b.iii. will now read: "An assessment of projected affordability and identification of all potential sources of funding for enhanced ammonia treatment. In the case of publicly owned treatment works, include an evaluation of the required sewer use fee versus median household income".*

Under provisions of the state statute governing Freedom of Information, DEQ cannot give assurance that confidential business information provided by an industrial applicant for the PIP will be protected against public disclosure. While the State Water Control Law (§62.1-44.21. Information to be furnished to Board) and VPDES Permit Regulation (9VAC25-31-80 and -860. Confidentiality of Information) appear to provide some protection for “secret formulae, processes, or methods” claimed as confidential, DEQ is unsure this would apply to the PIP, as “Information required by VPDES application forms provided by the department may not be claimed confidential”. Therefore, it is recommended that this type of information should not be included with the application.

In response to the comments received, to provide more flexibility in the time frame for issuing permits incorporating the new criteria, staff has proposed changes to the classes of permittees outlined in Part G.1 and extended the effective dates of the criteria by 6 months for each of the three tiers. The phased effective date schedule in Part G.1 applies to permits being reissued and does not prompt permit modifications to incorporate the new ammonia water quality criteria. Staff has not added VMA’s proposed paragraph G.3.a.v., as it extends authority beyond that identified in the state code.

4. Commenter: Appalachian Power Co.; APCo uses ammonia and related chemical compounds in various water treatment and air pollution control capacities. The list of components of an extended compliance schedule demonstration in proposed language 9VAC25-260-155.G.3.b may not be inclusive of all potential components of such a demonstration. Requests that the language in 9VAC25-260-155-G.3.b.ii and iv be modified to provide flexibility to permittees for whom source reduction may be the most favorable strategy and provide time to select the appropriate alternative compliance mechanism.

DEQ’s Response - *The intent of the proposed phased implementation plan is that it be applicable to all VPDES permits issued pursuant to 9VAC25-31, Virginia Pollutant Discharge Elimination System (VPDES) Permit Regulation. Staff has proposed changes to 9VAC25-260-155.G.3.b.ii and iv to recognize source reduction alternatives for industries.*

5. Commenter: U.S. Environmental Protection Agency; Consider using a different term in the compliance schedule context or, at a minimum, clarify: (1) what the term “highest achievable condition (HAC)” means with respect to compliance schedules; and, (2) that its use here does not imply that an applicant for a compliance schedule is also applying for, or obtaining, a water quality standards variance. Work with EPA so they may understand what the state intends with this proposal and to identify options to achieve the state’s intended outcome. The compliance schedule language in the PIP is not subject to EPA water quality standards review under Clean Water Act Section 303(c); however, they constitute NPDES program revisions subject to EPA review under Section 402.

DEQ’s Response - *Proposed section 9VAC25-260-155.G.3.b(v) states: “An evaluation, prepared by a professional engineer registered in Virginia, of the **highest achievable condition (HAC) regarding nitrification capabilities of the current treatment facility design** under the influent loading conditions expected during the term of the VPDES permit and the design loading conditions.” DEQ believes it is apparent the term “highest achievable condition” refers to*

wastewater within the facility and subsequent quality of effluent and not the highest achievable condition of instream water quality of the receiving stream.

EPA has been a participant in the Regulatory Advisory Panel during the development of this Phased Implementation Program and throughout the promulgation of ammonia criteria amendments and DEQ will continue to work with, and seek input from EPA as this issue progresses.

DEQ acknowledges EPA's finding that the PIP language is not subject to WQS review under CWA Section 303(c), but will be subject to EPA review as an element of Virginia's VPDES Permit Program under CWA Section 402.

*Regarding EPA's prior comment (dated 11/6/17; submitted during the first public review period) on inclusion of the **4-day average chronic criterion**, DEQ has revised the proposal to add the following text. This appears before each section for derivation of the chronic criteria, covering the three possible combinations for mussels and early life stages present or absent: "In addition, the 4-day average concentration of total ammonia nitrogen (in mg N/L) shall not exceed 2.5 times the chronic criterion within a 30-day period, more than once every three years on the average."*

While inclusion of the 4-day average chronic criterion is a change since the amendments were proposed for public comment, research done by DEQ staff indicate that it is not a significant change in terms of impact on permitted dischargers or potential for additional assessments of state waters as "impaired" due to failure to meet the criterion. Regarding the potential impact on permitted dischargers, in accordance with EPA's guidance, if the ammonia chronic criteria are implemented using the 30Q10 stream flow, then no further conditions are necessary. Implementation of the 30-day chronic criteria at 30Q10 is protective of the 4-day average chronic criteria; therefore, no additional impact on VPDES permittees is anticipated due to inclusion of the 4-day average criteria in the proposal.

The results from a statistical analysis of ambient monitoring data strongly suggests that in the majority of free-flowing streams in the Commonwealth, attainment of the 4-day average ammonia criterion can be presumed when the 30-day average criterion is met. Site-specific variability of ammonia was determined from datasets spanning multiple years generated in 20 streams across the state. Using the variability determined for each stream, 200 simulated annual datasets were created. These datasets were then used to estimate the likelihood that a given waterbody would exceed the 4-day average criterion while meeting the 30-day average criterion. This analysis found that the variability of ammonia in 75% of the examined waterbodies is so low that there is a negligible risk of the 4-day mean criterion being exceeded when the 30-day mean criterion is met. The statewide percentage is likely much higher than 75%, since the streams that were selected for this analysis had been targeted for intensive monitoring because upstream sources elevate their risk of experiencing degraded water quality.

6. Commenter: Chesapeake Bay Foundation; Recommend language be included to define a specific number of permit cycles and suggest that the limit be two 5-year permit cycles or an applicable TMDL deadline for the tributary to which the facility discharges, whichever is earliest. Expand

grant funding to include low interest financing programs such as Virginia’s Clean Water Revolving Loan Program. Explore opportunities to incentivize additional total nitrogen reductions, which may coincide with upgrades needed for achieving ammonia criteria but are not required.

DEQ’s Response - *The controlling requirement for the schedule under the PIP will be that “compliance shall be achieved as soon as possible in accordance with 9 VAC 25-31-250.A.1”.*

Regarding grant funding, DEQ cannot unilaterally expand availability because of dependence on General Assembly appropriations to the Water Quality Improvement Fund (WQIF) and any restrictions put on the use of those funds in budget language. However, the 2018 General Assembly revised the eligibility provisions of the WQIF to specifically identify “cost effective technologies to reduce loads of...nitrogen-containing ammonia” to the list of project types eligible for grant funding. Further, DEQ’s Clean Water Revolving Loan Fund Program does make available low interest loans for plant retrofits, sometimes with zero-interest (and on occasion “principal forgiveness”) in cases of severe fiscal stress on the recipient.

DEQ acknowledges the recommendation to explore additional incentives for nitrogen reductions to coincide with upgrades needed to achieve ammonia criteria. As stated above, any financial incentives are dependent on General Assembly appropriations to the WQIF or other funds and any restrictions put on the use of those funds in budget language.

ATTORNEY GENERAL’S CERTIFICATION

The Office of the Attorney General has been asked to review the proposed amendments and certify the Board’s authority to adopt them. If certification is received before the Board meeting, this will be reported.

STAFF RECOMMENDATION

Staff recommends the Board adopt the proposed amendments to the freshwater ammonia criteria for the protection of aquatic life, 9 VAC 25-260-155, as presented.

PRESENTER CONTACT INFORMATION:

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ATTACHMENTS

Attachment 1: Regulatory Advisory Panel Membership

Attachment 2: Virginia Water Quality Standards (9 VAC 25-260-155), full text of proposed technical amendments to the freshwater ammonia criteria

Attachment 3: Virginia Water Quality Standards (9 VAC 25-260-155), full text of proposed Phased Implementation Program to accompany the freshwater ammonia criteria

Attachment 4: Listing of commenters responding during the second public review period, that closed October 5, 2018

Memo to the SWCB – Approval of Amendments to the Freshwater Ammonia WQ Criteria

Jutta Schneider

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Attachment 5: Department of Planning and Budget's Economic Impact Statement (6/16/17); section on ammonia criteria begins on page 2

Attachment 6: Final Regulation Agency Background Document

ATTACHMENT 1

Regulatory Advisory Panel Membership ("Follow-on" Rulemaking to Triennial Review – including Freshwater Ammonia Criteria)

Organization	Contact #1	Contact #2
Chesapeake Bay Foundation	Joe Wood, CBF-VA Staff Scientist	Rebecca LePrell, CBF-VA Exec. Dir.
City of Richmond	Robert Steidel, DPU Director	Grace LeRose, TMDL Coordinator
Dominion Power	Oula Shehab-Dandan	
EPA Region 3	Cheryl Atkinson, EPA Region 3 Water Protection Division/Office of Watersheds	Bill Richardson, EPA Region III
Friends of the Rivers of Virginia	Patti Jackson	Bill Tanger
James River Association	Jamie Brunkow, JRA-Lower James Riverkeeper	Bill Street, JRA- Executive Director
U.S. Fish and Wildlife Service	Susan Lingenfelter, VA Field Office	Serena Ciparis, VA.Tech (USFWS Proxy)
VA Association of Municipal Wastewater Agencies (VAMWA)	Ted Henefin, VAMWA President	Jamie Heisig-Mitchell (HRSD)
VA Chamber of Commerce Natural Resources Committee	Clayton Walton (alternate for Dennis Tracy)	
Virginia Coal Association (now VA Coal & Energy Alliance)	John Paul Jones, Alpha Natural Resources Services, LLC	
VA Dept. of Conservation and Recreation	Thomas Smith, DCR-Natural Heritage Div. Dir.	Rene Hypes, DCR- Natural Heritage Program
VA Department of Health (VDH)	Margaret Smigo, Waterborne Hazards Control Manager	Dwight Flammia, State Public Health Toxicologist
VA Department of Game and Inland Fisheries (DGIF)	Ray Fernald, DGIF-Env. Services Manager	Ernie Aschenbach, Env. Services Biologist
VA Manufacturers Association (VMA) and VA Mining Issues Group	Andrew Parker, AdvanSix/Hopewell	Brooks Smith, Troutman Sanders

Invited, but did not participate: U.S. Navy – Naval Facilities Engr. Command; Virginia Save our Streams; Hampton Roads Planning District Commission; The Nature Conservancy, VA Chamber of Commerce Natural Resources Committee; VA Farm Bureau Federation; VA Institute of Marine Science

Dropped off during rulemaking: Water Environment Federation

ATTACHMENT 2 [Changes since proposed shown in red]

9VAC25-260-155. Ammonia surface water quality criteria.

A. The Department of Environmental Quality, after consultation with the Virginia Department of Game and Inland Fisheries and the U.S. Fish and Wildlife Service, has determined that the majority of Virginia freshwaters are likely to contain, or have contained in the past, freshwater mussel species in the family Unionidae and contain early life stages of fish during most times of the year. Therefore, the ammonia criteria presented in subsections B and C of this section are designed to provide protection to these species and life stages. In an instance where it can be adequately demonstrated that either freshwater mussels or early life stages of fish are not present in a specific waterbody, potential options for alternate, site-specific criteria are presented in subsection D of this section. Acute criteria are a one-hour average concentration not to be exceeded more than once every three years¹ on the average, and chronic criteria are 30-day average concentrations not to be exceeded more than once every three years on the average.² [In addition, the 4-day average concentration of total ammonia nitrogen (in mg N/L) shall not exceed 2.5 times the chronic criterion within a 30-day period, more than once every three years on the average.]

B. The one-hour average concentration of total ammonia nitrogen (in mg N/L) in freshwater shall not exceed, more than once every three years on the average¹; the acute criteria for total ammonia (in mg N/L) for freshwaters with trout absent or present are below:

Acute Ammonia Freshwater Criteria Total Ammonia Nitrogen (mg N/L)

pH	Trout Present	Trout Absent
6.5	32.6	48.8
6.6	31.3	46.8
6.7	29.8	44.6
6.8	28.1	42.0
6.9	26.2	39.1
7.0	24.1	36.1
7.1	22.0	32.8
7.2	19.7	29.5
7.3	17.5	26.2
7.4	15.4	23.0
7.5	13.3	19.9
7.6	11.4	17.0
7.7	9.65	14.4
7.8	8.11	12.1
7.9	6.77	10.1
8.0	5.62	8.40
8.1	4.64	6.95

8.2	3.83	5.72
8.3	3.15	4.71
8.4	2.59	3.88
8.5	2.14	3.20
8.6	1.77	2.65
8.7	1.47	2.20
8.8	1.23	1.84
8.9	1.04	1.56
9.0	0.885	1.32

Acute Ammonia Freshwater Criteria

Total Ammonia Nitrogen (mg N/L)

TROUT ABSENT

Temperature (°C)

<u>pH</u>	<u>0-1 0</u>	<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>	<u>15</u>	<u>16</u>	<u>17</u>	<u>18</u>	<u>19</u>	<u>20</u>	<u>21</u>	<u>22</u>	<u>23</u>	<u>24</u>	<u>25</u>	<u>26</u>	<u>27</u>	<u>28</u>	<u>29</u>	<u>30</u>
<u>6.5</u>	<u>51</u>	<u>48</u>	<u>44</u>	<u>41</u>	<u>37</u>	<u>34</u>	<u>32</u>	<u>29</u>	<u>27</u>	<u>25</u>	<u>23</u>	<u>21</u>	<u>19</u>	<u>18</u>	<u>16</u>	<u>15</u>	<u>14</u>	<u>13</u>	<u>12</u>	<u>11</u>	<u>9.9</u>
<u>6.6</u>	<u>49</u>	<u>46</u>	<u>42</u>	<u>39</u>	<u>36</u>	<u>33</u>	<u>30</u>	<u>28</u>	<u>26</u>	<u>24</u>	<u>22</u>	<u>20</u>	<u>18</u>	<u>17</u>	<u>16</u>	<u>14</u>	<u>13</u>	<u>12</u>	<u>11</u>	<u>10</u>	<u>9.5</u>
<u>6.7</u>	<u>46</u>	<u>44</u>	<u>40</u>	<u>37</u>	<u>34</u>	<u>31</u>	<u>29</u>	<u>27</u>	<u>24</u>	<u>22</u>	<u>21</u>	<u>19</u>	<u>18</u>	<u>16</u>	<u>15</u>	<u>14</u>	<u>13</u>	<u>12</u>	<u>11</u>	<u>9.8</u>	<u>9.0</u>
<u>6.8</u>	<u>44</u>	<u>41</u>	<u>38</u>	<u>35</u>	<u>32</u>	<u>30</u>	<u>27</u>	<u>25</u>	<u>23</u>	<u>21</u>	<u>20</u>	<u>18</u>	<u>17</u>	<u>15</u>	<u>14</u>	<u>13</u>	<u>12</u>	<u>11</u>	<u>10</u>	<u>9.2</u>	<u>8.5</u>
<u>6.9</u>	<u>41</u>	<u>38</u>	<u>35</u>	<u>32</u>	<u>30</u>	<u>28</u>	<u>25</u>	<u>23</u>	<u>21</u>	<u>20</u>	<u>18</u>	<u>17</u>	<u>15</u>	<u>14</u>	<u>13</u>	<u>12</u>	<u>11</u>	<u>10</u>	<u>9.4</u>	<u>8.6</u>	<u>7.9</u>
<u>7.0</u>	<u>38</u>	<u>35</u>	<u>33</u>	<u>30</u>	<u>28</u>	<u>25</u>	<u>23</u>	<u>21</u>	<u>20</u>	<u>18</u>	<u>17</u>	<u>15</u>	<u>14</u>	<u>13</u>	<u>12</u>	<u>11</u>	<u>10</u>	<u>9.4</u>	<u>8.6</u>	<u>7.9</u>	<u>7.3</u>
<u>7.1</u>	<u>34</u>	<u>32</u>	<u>30</u>	<u>27</u>	<u>25</u>	<u>23</u>	<u>21</u>	<u>20</u>	<u>18</u>	<u>17</u>	<u>15</u>	<u>14</u>	<u>13</u>	<u>12</u>	<u>11</u>	<u>10</u>	<u>9.3</u>	<u>8.5</u>	<u>7.9</u>	<u>7.2</u>	<u>6.7</u>
<u>7.2</u>	<u>31</u>	<u>29</u>	<u>27</u>	<u>25</u>	<u>23</u>	<u>21</u>	<u>19</u>	<u>18</u>	<u>16</u>	<u>15</u>	<u>14</u>	<u>13</u>	<u>12</u>	<u>11</u>	<u>9.8</u>	<u>9.1</u>	<u>8.3</u>	<u>7.7</u>	<u>7.1</u>	<u>6.5</u>	<u>6.0</u>
<u>7.3</u>	<u>27</u>	<u>26</u>	<u>24</u>	<u>22</u>	<u>20</u>	<u>18</u>	<u>17</u>	<u>16</u>	<u>14</u>	<u>13</u>	<u>12</u>	<u>11</u>	<u>10</u>	<u>9.5</u>	<u>8.7</u>	<u>8.0</u>	<u>7.4</u>	<u>6.8</u>	<u>6.3</u>	<u>5.8</u>	<u>5.3</u>
<u>7.4</u>	<u>24</u>	<u>22</u>	<u>21</u>	<u>19</u>	<u>18</u>	<u>16</u>	<u>15</u>	<u>14</u>	<u>13</u>	<u>12</u>	<u>11</u>	<u>9.8</u>	<u>9.0</u>	<u>8.3</u>	<u>7.7</u>	<u>7.0</u>	<u>6.5</u>	<u>6.0</u>	<u>5.5</u>	<u>5.1</u>	<u>4.7</u>
<u>7.5</u>	<u>21</u>	<u>19</u>	<u>18</u>	<u>17</u>	<u>15</u>	<u>14</u>	<u>13</u>	<u>12</u>	<u>11</u>	<u>10</u>	<u>9.2</u>	<u>8.5</u>	<u>7.8</u>	<u>7.2</u>	<u>6.6</u>	<u>6.1</u>	<u>5.6</u>	<u>5.2</u>	<u>4.8</u>	<u>4.4</u>	<u>4.0</u>
<u>7.6</u>	<u>18</u>	<u>17</u>	<u>15</u>	<u>14</u>	<u>13</u>	<u>12</u>	<u>11</u>	<u>10</u>	<u>9.3</u>	<u>8.6</u>	<u>7.9</u>	<u>7.3</u>	<u>6.7</u>	<u>6.2</u>	<u>5.7</u>	<u>5.2</u>	<u>4.8</u>	<u>4.4</u>	<u>4.1</u>	<u>3.8</u>	<u>3.5</u>
<u>7.7</u>	<u>15</u>	<u>14</u>	<u>13</u>	<u>12</u>	<u>11</u>	<u>10</u>	<u>9.3</u>	<u>8.6</u>	<u>7.9</u>	<u>7.3</u>	<u>6.7</u>	<u>6.2</u>	<u>5.7</u>	<u>5.2</u>	<u>4.8</u>	<u>4.4</u>	<u>4.1</u>	<u>3.8</u>	<u>3.5</u>	<u>3.2</u>	<u>2.9</u>
<u>7.8</u>	<u>13</u>	<u>12</u>	<u>11</u>	<u>10</u>	<u>9.3</u>	<u>8.5</u>	<u>7.9</u>	<u>7.2</u>	<u>6.7</u>	<u>6.1</u>	<u>5.6</u>	<u>5.2</u>	<u>4.8</u>	<u>4.4</u>	<u>4.0</u>	<u>3.7</u>	<u>3.4</u>	<u>3.2</u>	<u>2.9</u>	<u>2.7</u>	<u>2.5</u>
<u>7.9</u>	<u>11</u>	<u>9.9</u>	<u>9.1</u>	<u>8.4</u>	<u>7.7</u>	<u>7.1</u>	<u>6.6</u>	<u>3.0</u>	<u>5.6</u>	<u>5.1</u>	<u>4.7</u>	<u>4.3</u>	<u>4.0</u>	<u>3.7</u>	<u>3.4</u>	<u>3.1</u>	<u>2.9</u>	<u>2.6</u>	<u>2.4</u>	<u>2.2</u>	<u>2.1</u>
<u>8.0</u>	<u>8.8</u>	<u>8.2</u>	<u>7.6</u>	<u>7.0</u>	<u>6.4</u>	<u>5.9</u>	<u>5.4</u>	<u>5.0</u>	<u>4.6</u>	<u>4.2</u>	<u>3.9</u>	<u>3.6</u>	<u>3.3</u>	<u>3.0</u>	<u>2.8</u>	<u>2.6</u>	<u>2.4</u>	<u>2.2</u>	<u>2.0</u>	<u>1.9</u>	<u>1.7</u>
<u>8.1</u>	<u>7.2</u>	<u>6.8</u>	<u>6.3</u>	<u>5.8</u>	<u>5.3</u>	<u>4.9</u>	<u>4.5</u>	<u>4.1</u>	<u>3.8</u>	<u>3.5</u>	<u>3.2</u>	<u>3.0</u>	<u>2.7</u>	<u>2.5</u>	<u>2.3</u>	<u>2.1</u>	<u>2.0</u>	<u>1.8</u>	<u>1.7</u>	<u>1.5</u>	<u>1.4</u>
<u>8.2</u>	<u>6.0</u>	<u>5.6</u>	<u>5.2</u>	<u>4.8</u>	<u>4.4</u>	<u>4.0</u>	<u>3.7</u>	<u>3.4</u>	<u>3.1</u>	<u>2.9</u>	<u>2.7</u>	<u>2.4</u>	<u>2.3</u>	<u>2.1</u>	<u>1.9</u>	<u>1.8</u>	<u>1.6</u>	<u>1.5</u>	<u>1.4</u>	<u>1.3</u>	<u>1.2</u>
<u>8.3</u>	<u>4.9</u>	<u>4.6</u>	<u>4.3</u>	<u>3.9</u>	<u>3.6</u>	<u>3.3</u>	<u>3.1</u>	<u>2.8</u>	<u>2.6</u>	<u>2.4</u>	<u>2.2</u>	<u>2.0</u>	<u>1.9</u>	<u>1.7</u>	<u>1.6</u>	<u>1.4</u>	<u>1.3</u>	<u>1.2</u>	<u>1.1</u>	<u>1.0</u>	<u>0.9 6</u>
<u>8.4</u>	<u>4.1</u>	<u>3.8</u>	<u>3.5</u>	<u>3.2</u>	<u>3.0</u>	<u>2.7</u>	<u>2.5</u>	<u>2.3</u>	<u>2.1</u>	<u>2.0</u>	<u>1.8</u>	<u>1.7</u>	<u>1.5</u>	<u>1.4</u>	<u>1.3</u>	<u>1.2</u>	<u>1.1</u>	<u>1.0</u>	<u>0.93</u>	<u>0.86</u>	<u>0.7 9</u>
<u>8.5</u>	<u>3.3</u>	<u>3.1</u>	<u>2.9</u>	<u>2.7</u>	<u>2.4</u>	<u>2.3</u>	<u>2.1</u>	<u>1.9</u>	<u>1.8</u>	<u>1.6</u>	<u>1.5</u>	<u>1.4</u>	<u>1.3</u>	<u>1.2</u>	<u>1.1</u>	<u>0.98</u>	<u>0.90</u>	<u>0.83</u>	<u>0.77</u>	<u>0.71</u>	<u>0.6</u>

																					5
8.6	2.8	2.6	2.4	2.2	2.0	1.9	1.7	1.6	1.5	1.3	1.2	1.1	1.0	0.96	0.88	0.81	0.75	0.69	0.63	0.58	0.5 4
8.7	2.3	2.2	2.0	1.8	1.7	1.6	1.4	1.3	1.2	1.1	1.0	0.94	0.87	0.80	0.74	0.68	0.62	0.57	0.53	0.49	0.4 5
8.8	1.9	1.8	1.7	1.5	1.4	1.3	1.2	1.1	1.0	0.93	0.86	0.79	0.73	0.67	0.62	0.57	0.52	0.48	0.44	0.41	0.3 7
8.9	1.6	1.5	1.4	1.3	1.2	1.1	1.0	0.93	0.85	0.79	0.72	0.67	0.61	0.56	0.52	0.48	0.44	0.40	0.37	0.34	0.3 2
9.0	1.4	1.3	1.2	1.1	1.0	0.93	0.86	0.79	0.73	0.67	0.62	0.57	0.52	0.48	0.44	0.41	0.37	0.34	0.32	0.29	0.2 7

<div> <div>Acute Ammonia Freshwater Criteria</div> <div>Total Ammonia Nitrogen (mg N/L)</div> <div>TROUT PRESENT</div> </div>																	
Temperature (°C)																	
pH	0-14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
<u>6.5</u>	<u>33</u>	<u>33</u>	<u>32</u>	<u>29</u>	<u>27</u>	<u>25</u>	<u>23</u>	<u>21</u>	<u>19</u>	<u>18</u>	<u>16</u>	<u>15</u>	<u>14</u>	<u>13</u>	<u>12</u>	<u>11</u>	<u>9.9</u>
<u>6.6</u>	<u>31</u>	<u>31</u>	<u>30</u>	<u>28</u>	<u>26</u>	<u>24</u>	<u>22</u>	<u>20</u>	<u>18</u>	<u>17</u>	<u>16</u>	<u>14</u>	<u>13</u>	<u>12</u>	<u>11</u>	<u>10</u>	<u>9.5</u>
<u>6.7</u>	<u>30</u>	<u>30</u>	<u>29</u>	<u>27</u>	<u>24</u>	<u>22</u>	<u>21</u>	<u>19</u>	<u>18</u>	<u>16</u>	<u>15</u>	<u>14</u>	<u>13</u>	<u>12</u>	<u>11</u>	<u>9.8</u>	<u>9.0</u>
<u>6.8</u>	<u>28</u>	<u>28</u>	<u>27</u>	<u>25</u>	<u>23</u>	<u>21</u>	<u>20</u>	<u>18</u>	<u>17</u>	<u>15</u>	<u>14</u>	<u>13</u>	<u>12</u>	<u>11</u>	<u>10</u>	<u>9.2</u>	<u>8.5</u>
<u>6.9</u>	<u>26</u>	<u>26</u>	<u>25</u>	<u>23</u>	<u>21</u>	<u>20</u>	<u>18</u>	<u>17</u>	<u>15</u>	<u>14</u>	<u>13</u>	<u>12</u>	<u>11</u>	<u>10</u>	<u>9.4</u>	<u>8.6</u>	<u>7.9</u>
<u>7.0</u>	<u>24</u>	<u>24</u>	<u>23</u>	<u>21</u>	<u>20</u>	<u>18</u>	<u>17</u>	<u>15</u>	<u>14</u>	<u>13</u>	<u>12</u>	<u>11</u>	<u>10</u>	<u>9.4</u>	<u>8.6</u>	<u>8.0</u>	<u>7.3</u>
<u>7.1</u>	<u>22</u>	<u>22</u>	<u>21</u>	<u>20</u>	<u>18</u>	<u>17</u>	<u>15</u>	<u>14</u>	<u>13</u>	<u>12</u>	<u>11</u>	<u>10</u>	<u>9.3</u>	<u>8.5</u>	<u>7.9</u>	<u>7.2</u>	<u>6.7</u>
<u>7.2</u>	<u>20</u>	<u>20</u>	<u>19</u>	<u>18</u>	<u>16</u>	<u>15</u>	<u>14</u>	<u>13</u>	<u>12</u>	<u>11</u>	<u>9.8</u>	<u>9.1</u>	<u>8.3</u>	<u>7.7</u>	<u>7.1</u>	<u>6.5</u>	<u>6.0</u>
<u>7.3</u>	<u>18</u>	<u>18</u>	<u>17</u>	<u>16</u>	<u>14</u>	<u>13</u>	<u>12</u>	<u>11</u>	<u>10</u>	<u>9.5</u>	<u>8.7</u>	<u>8.0</u>	<u>7.4</u>	<u>6.8</u>	<u>6.3</u>	<u>5.8</u>	<u>5.3</u>
<u>7.4</u>	<u>15</u>	<u>15</u>	<u>15</u>	<u>14</u>	<u>13</u>	<u>12</u>	<u>11</u>	<u>9.8</u>	<u>9.0</u>	<u>8.3</u>	<u>7.7</u>	<u>7.0</u>	<u>6.5</u>	<u>6.0</u>	<u>5.5</u>	<u>5.1</u>	<u>4.7</u>
<u>7.5</u>	<u>13</u>	<u>13</u>	<u>13</u>	<u>12</u>	<u>11</u>	<u>10</u>	<u>9.2</u>	<u>8.5</u>	<u>7.8</u>	<u>7.2</u>	<u>6.6</u>	<u>6.1</u>	<u>5.6</u>	<u>5.2</u>	<u>4.8</u>	<u>4.4</u>	<u>4.0</u>
<u>7.6</u>	<u>11</u>	<u>11</u>	<u>11</u>	<u>10</u>	<u>9.3</u>	<u>8.6</u>	<u>7.9</u>	<u>7.3</u>	<u>6.7</u>	<u>6.2</u>	<u>5.7</u>	<u>5.2</u>	<u>4.8</u>	<u>4.4</u>	<u>4.1</u>	<u>3.8</u>	<u>3.5</u>

<u>7.7</u>	<u>9.6</u>	<u>9.6</u>	<u>9.3</u>	<u>8.6</u>	<u>7.9</u>	<u>7.3</u>	<u>6.7</u>	<u>6.2</u>	<u>5.7</u>	<u>5.2</u>	<u>4.8</u>	<u>4.4</u>	<u>4.1</u>	<u>3.8</u>	<u>3.5</u>	<u>3.2</u>	<u>3.0</u>
<u>7.8</u>	<u>8.1</u>	<u>8.1</u>	<u>7.9</u>	<u>7.2</u>	<u>6.7</u>	<u>6.1</u>	<u>5.6</u>	<u>5.2</u>	<u>4.8</u>	<u>4.4</u>	<u>4.0</u>	<u>3.7</u>	<u>3.4</u>	<u>3.2</u>	<u>2.9</u>	<u>2.7</u>	<u>2.5</u>
<u>7.9</u>	<u>6.8</u>	<u>6.8</u>	<u>6.6</u>	<u>6.0</u>	<u>5.6</u>	<u>5.1</u>	<u>4.7</u>	<u>4.3</u>	<u>4.0</u>	<u>3.7</u>	<u>3.4</u>	<u>3.1</u>	<u>2.9</u>	<u>2.6</u>	<u>2.4</u>	<u>2.2</u>	<u>2.1</u>
<u>8.0</u>	<u>5.6</u>	<u>5.6</u>	<u>5.4</u>	<u>5.0</u>	<u>4.6</u>	<u>4.2</u>	<u>3.9</u>	<u>3.6</u>	<u>3.3</u>	<u>3.0</u>	<u>2.8</u>	<u>2.6</u>	<u>2.4</u>	<u>2.2</u>	<u>2.0</u>	<u>1.9</u>	<u>1.7</u>
<u>8.1</u>	<u>4.6</u>	<u>4.6</u>	<u>4.5</u>	<u>4.1</u>	<u>3.8</u>	<u>3.5</u>	<u>3.2</u>	<u>3.0</u>	<u>2.7</u>	<u>2.5</u>	<u>2.3</u>	<u>2.1</u>	<u>2.0</u>	<u>1.8</u>	<u>1.7</u>	<u>1.5</u>	<u>1.4</u>
<u>8.2</u>	<u>3.8</u>	<u>3.8</u>	<u>3.7</u>	<u>3.5</u>	<u>3.1</u>	<u>2.9</u>	<u>2.7</u>	<u>2.4</u>	<u>2.3</u>	<u>2.1</u>	<u>1.9</u>	<u>1.8</u>	<u>1.6</u>	<u>1.5</u>	<u>1.4</u>	<u>1.3</u>	<u>1.2</u>
<u>8.3</u>	<u>3.1</u>	<u>3.1</u>	<u>3.1</u>	<u>2.8</u>	<u>2.6</u>	<u>2.4</u>	<u>2.2</u>	<u>2.0</u>	<u>1.9</u>	<u>1.7</u>	<u>1.6</u>	<u>1.4</u>	<u>1.3</u>	<u>1.2</u>	<u>1.1</u>	<u>1.0</u>	<u>0.96</u>
<u>8.4</u>	<u>2.6</u>	<u>2.6</u>	<u>2.5</u>	<u>2.3</u>	<u>2.1</u>	<u>2.0</u>	<u>1.8</u>	<u>1.7</u>	<u>1.5</u>	<u>1.4</u>	<u>1.3</u>	<u>1.2</u>	<u>1.1</u>	<u>1.0</u>	<u>0.93</u>	<u>0.86</u>	<u>0.79</u>
<u>8.5</u>	<u>2.1</u>	<u>2.1</u>	<u>2.1</u>	<u>1.9</u>	<u>1.8</u>	<u>1.6</u>	<u>1.5</u>	<u>1.4</u>	<u>1.3</u>	<u>1.2</u>	<u>1.1</u>	<u>0.98</u>	<u>0.90</u>	<u>0.83</u>	<u>0.77</u>	<u>0.71</u>	<u>0.65</u>
<u>8.6</u>	<u>1.8</u>	<u>1.8</u>	<u>1.7</u>	<u>1.6</u>	<u>1.5</u>	<u>1.3</u>	<u>1.2</u>	<u>1.1</u>	<u>1.0</u>	<u>0.96</u>	<u>0.88</u>	<u>0.81</u>	<u>0.75</u>	<u>0.69</u>	<u>0.63</u>	<u>0.59</u>	<u>0.54</u>
<u>8.7</u>	<u>1.5</u>	<u>1.5</u>	<u>1.4</u>	<u>1.3</u>	<u>1.2</u>	<u>1.1</u>	<u>1.0</u>	<u>0.94</u>	<u>0.87</u>	<u>0.80</u>	<u>0.74</u>	<u>0.68</u>	<u>0.62</u>	<u>0.57</u>	<u>0.53</u>	<u>0.49</u>	<u>0.45</u>
<u>8.8</u>	<u>1.2</u>	<u>1.2</u>	<u>1.2</u>	<u>1.1</u>	<u>1.0</u>	<u>0.93</u>	<u>0.86</u>	<u>0.79</u>	<u>0.73</u>	<u>0.67</u>	<u>0.62</u>	<u>0.57</u>	<u>0.52</u>	<u>0.48</u>	<u>0.44</u>	<u>0.41</u>	<u>0.37</u>
<u>8.9</u>	<u>1.0</u>	<u>1.0</u>	<u>1.0</u>	<u>0.93</u>	<u>0.85</u>	<u>0.79</u>	<u>0.72</u>	<u>0.67</u>	<u>0.61</u>	<u>0.56</u>	<u>0.52</u>	<u>0.48</u>	<u>0.44</u>	<u>0.40</u>	<u>0.37</u>	<u>0.34</u>	<u>0.32</u>
<u>9.0</u>	<u>0.88</u>	<u>0.88</u>	<u>0.86</u>	<u>0.79</u>	<u>0.73</u>	<u>0.67</u>	<u>0.62</u>	<u>0.57</u>	<u>0.52</u>	<u>0.48</u>	<u>0.44</u>	<u>0.41</u>	<u>0.37</u>	<u>0.34</u>	<u>0.32</u>	<u>0.29</u>	<u>0.27</u>

The acute criteria for trout present shall apply to all Class V-Stockable Trout Waters and Class VI-Natural Trout Waters as listed in 9VAC25-260-390 through 9VAC25-260-540. The acute criteria for trout absent apply to all other fresh waters.

To calculate total ammonia nitrogen acute criteria values in freshwater at different pH values than those listed in this subsection, use the following ~~formulas~~ equations and round the result to two significant digits:

Where trout are ~~present~~ absent:

Acute Criterion Concentration (mg N/L) =

0.275	+	39.0
$(1 + 10^{7.204 - \text{pH}})$		$(1 + 10^{\text{pH} - 7.204})$

$$0.7249 \times \left(\frac{0.0114}{1 + 10^{7.204 - \text{pH}}} \pm \frac{1.6181}{1 + 10^{\text{pH} - 7.204}} \right) \times \text{MIN}$$

Where MIN = 51.93 or $23.12 \times 10^{0.036 \times (20 - T)}$, whichever is less

T = Temperature in °C

Or where trout are ~~absent~~ present, whichever of the below calculation results is less:

Acute Criterion Concentration (mg N/L) =

$$\frac{0.411}{(1 + 10^{7.204 - \text{pH}})} + \frac{58.4}{(1 + 10^{\text{pH} - 7.204})}$$

~~¹The default design flow for calculating steady state waste load allocations for the acute ammonia criterion is the 1Q10 (see 9VAC25-260-140 B footnote 10) unless statistically valid methods are employed which demonstrate compliance with the duration and return frequency of the water quality criteria.~~

$$\left(\frac{0.275}{1 + 10^{7.204 - \text{pH}}} \pm \frac{39.0}{1 + 10^{\text{pH} - 7.204}} \right)$$

or

$$0.7249 \times \left(\frac{0.0114}{1 + 10^{7.204 - \text{pH}}} \pm \frac{1.6181}{1 + 10^{\text{pH} - 7.204}} \right) \times (23.12 \times 10^{0.036 \times (20 - T)})$$

T = Temperature in °C

~~B. C. The 30-day average concentration of chronic criteria for total ammonia nitrogen (in mg N/L) where freshwater mussels and early life stages of fish are present in freshwater shall not exceed, more than once every three years on the average², the chronic criteria are below:~~

~~Chronic Ammonia Freshwater Criteria~~

~~Early Life Stages of Fish Present~~

~~Total Ammonia Nitrogen (mg N/L)~~

pH	Temperature (°C)									
	0	14	16	18	20	22	24	26	28	30
6.5	6.67	6.67	6.06	5.33	4.68	4.12	3.62	3.18	2.80	2.46
6.6	6.57	6.57	5.97	5.25	4.61	4.05	3.56	3.13	2.75	2.42
6.7	6.44	6.44	5.86	5.15	4.52	3.98	3.50	3.07	2.70	2.37
6.8	6.29	6.29	5.72	5.03	4.42	3.89	3.42	3.00	2.64	2.32
6.9	6.12	6.12	5.56	4.89	4.30	3.78	3.32	2.92	2.57	2.25
7.0	5.91	5.91	5.37	4.72	4.15	3.65	3.21	2.82	2.48	2.18
7.1	5.67	5.67	5.15	4.53	3.98	3.50	3.08	2.70	2.38	2.09

7.2	5.39	5.39	4.90	4.34	3.78	3.33	2.92	2.57	2.26	1.99
7.3	5.08	5.08	4.64	4.06	3.57	3.13	2.76	2.42	2.13	1.87
7.4	4.73	4.73	4.30	3.78	3.32	2.92	2.57	2.26	1.98	1.74
7.5	4.36	4.36	3.97	3.49	3.06	2.69	2.37	2.08	1.83	1.61
7.6	3.98	3.98	3.64	3.18	2.79	2.45	2.16	1.90	1.67	1.47
7.7	3.58	3.58	3.25	2.86	2.54	2.21	1.94	1.71	1.50	1.32
7.8	3.18	3.18	2.89	2.54	2.23	1.96	1.73	1.52	1.33	1.17
7.9	2.80	2.80	2.54	2.24	1.96	1.73	1.52	1.33	1.17	1.03
8.0	2.43	2.43	2.21	1.94	1.71	1.50	1.32	1.16	1.02	0.897
8.1	2.10	2.10	1.91	1.68	1.47	1.29	1.14	1.00	0.879	0.773
8.2	1.79	1.79	1.63	1.43	1.26	1.11	0.973	0.855	0.752	0.661
8.3	1.52	1.52	1.39	1.22	1.07	0.941	0.827	0.727	0.639	0.562
8.4	1.29	1.29	1.17	1.03	0.906	0.796	0.700	0.615	0.541	0.475
8.5	1.09	1.09	0.990	0.870	0.765	0.672	0.591	0.520	0.457	0.401
8.6	0.920	0.920	0.836	0.735	0.646	0.568	0.499	0.439	0.386	0.339
8.7	0.778	0.778	0.707	0.622	0.547	0.480	0.422	0.371	0.326	0.287
8.8	0.664	0.664	0.604	0.528	0.464	0.408	0.359	0.315	0.277	0.244
8.9	0.565	0.565	0.513	0.454	0.397	0.349	0.306	0.269	0.237	0.208
9.0	0.486	0.486	0.442	0.389	0.342	0.300	0.264	0.232	0.204	0.179

Chronic Ammonia Freshwater Criteria
Mussels and Early Life Stages of Fish Present
Total Ammonia Nitrogen (mg N/L)

Temperature (°C)

pH	0-7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
<u>6.5</u>	<u>4.9</u>	<u>4.6</u>	<u>4.3</u>	<u>4.1</u>	<u>3.8</u>	<u>3.6</u>	<u>3.3</u>	<u>3.1</u>	<u>2.9</u>	<u>2.8</u>	<u>2.6</u>	<u>2.4</u>	<u>2.3</u>	<u>2.1</u>	<u>2.0</u>	<u>1.9</u>	<u>1.8</u>	<u>1.6</u>	<u>1.5</u>	<u>1.5</u>	<u>1.4</u>	<u>1.3</u>	<u>1.3</u>
<u>6.6</u>	<u>4.8</u>	<u>4.5</u>	<u>4.3</u>	<u>4.0</u>	<u>3.8</u>	<u>3.5</u>	<u>3.3</u>	<u>3.1</u>	<u>2.9</u>	<u>2.7</u>	<u>2.5</u>	<u>2.4</u>	<u>2.2</u>	<u>2.1</u>	<u>2.0</u>	<u>1.8</u>	<u>1.7</u>	<u>1.6</u>	<u>1.5</u>	<u>1.4</u>	<u>1.3</u>	<u>1.3</u>	<u>1.3</u>
<u>6.7</u>	<u>4.8</u>	<u>4.5</u>	<u>4.2</u>	<u>3.9</u>	<u>3.7</u>	<u>3.5</u>	<u>3.2</u>	<u>3.0</u>	<u>2.8</u>	<u>2.7</u>	<u>2.5</u>	<u>2.3</u>	<u>2.2</u>	<u>2.1</u>	<u>1.9</u>	<u>1.8</u>	<u>1.7</u>	<u>1.6</u>	<u>1.5</u>	<u>1.4</u>	<u>1.3</u>	<u>1.2</u>	<u>1.3</u>
<u>6.8</u>	<u>4.6</u>	<u>4.4</u>	<u>4.1</u>	<u>3.8</u>	<u>3.6</u>	<u>3.4</u>	<u>3.2</u>	<u>3.0</u>	<u>2.8</u>	<u>2.6</u>	<u>2.4</u>	<u>2.3</u>	<u>2.1</u>	<u>2.0</u>	<u>1.9</u>	<u>1.8</u>	<u>1.7</u>	<u>1.6</u>	<u>1.5</u>	<u>1.4</u>	<u>1.3</u>	<u>1.2</u>	<u>1.3</u>
<u>6.9</u>	<u>4.5</u>	<u>4.2</u>	<u>4.0</u>	<u>3.7</u>	<u>3.5</u>	<u>3.3</u>	<u>3.1</u>	<u>2.9</u>	<u>2.7</u>	<u>2.5</u>	<u>2.4</u>	<u>2.2</u>	<u>2.1</u>	<u>2.0</u>	<u>1.8</u>	<u>1.7</u>	<u>1.6</u>	<u>1.5</u>	<u>1.4</u>	<u>1.3</u>	<u>1.2</u>	<u>1.2</u>	<u>1.3</u>
<u>7.0</u>	<u>4.4</u>	<u>4.1</u>	<u>3.8</u>	<u>3.6</u>	<u>3.4</u>	<u>3.2</u>	<u>3.0</u>	<u>2.8</u>	<u>2.6</u>	<u>2.4</u>	<u>2.3</u>	<u>2.2</u>	<u>2.0</u>	<u>1.9</u>	<u>1.8</u>	<u>1.7</u>	<u>1.6</u>	<u>1.5</u>	<u>1.4</u>	<u>1.3</u>	<u>1.2</u>	<u>1.1</u>	<u>1.3</u>
<u>7.1</u>	<u>4.2</u>	<u>3.9</u>	<u>3.7</u>	<u>3.5</u>	<u>3.2</u>	<u>3.0</u>	<u>2.8</u>	<u>2.7</u>	<u>2.5</u>	<u>2.3</u>	<u>2.2</u>	<u>2.1</u>	<u>1.9</u>	<u>1.8</u>	<u>1.7</u>	<u>1.6</u>	<u>1.5</u>	<u>1.4</u>	<u>1.3</u>	<u>1.2</u>	<u>1.2</u>	<u>1.1</u>	<u>1.3</u>
<u>7.2</u>	<u>4.0</u>	<u>3.7</u>	<u>3.5</u>	<u>3.3</u>	<u>3.1</u>	<u>2.9</u>	<u>2.7</u>	<u>2.5</u>	<u>2.4</u>	<u>2.2</u>	<u>2.1</u>	<u>2.0</u>	<u>1.8</u>	<u>1.7</u>	<u>1.6</u>	<u>1.5</u>	<u>1.4</u>	<u>1.3</u>	<u>1.3</u>	<u>1.2</u>	<u>1.1</u>	<u>1.0</u>	<u>0.9</u>
<u>7.3</u>	<u>3.8</u>	<u>3.5</u>	<u>3.3</u>	<u>3.1</u>	<u>2.9</u>	<u>2.7</u>	<u>2.6</u>	<u>2.4</u>	<u>2.2</u>	<u>2.1</u>	<u>2.0</u>	<u>1.8</u>	<u>1.7</u>	<u>1.6</u>	<u>1.5</u>	<u>1.4</u>	<u>1.3</u>	<u>1.3</u>	<u>1.2</u>	<u>1.1</u>	<u>1.0</u>	<u>0.97</u>	<u>0.9</u>
<u>7.4</u>	<u>3.5</u>	<u>3.3</u>	<u>3.1</u>	<u>2.9</u>	<u>2.7</u>	<u>2.5</u>	<u>2.4</u>	<u>2.2</u>	<u>2.1</u>	<u>2.0</u>	<u>1.8</u>	<u>1.7</u>	<u>1.6</u>	<u>1.5</u>	<u>1.4</u>	<u>1.3</u>	<u>1.3</u>	<u>1.2</u>	<u>1.1</u>	<u>1.0</u>	<u>0.96</u>	<u>0.90</u>	<u>0.9</u>
<u>7.5</u>	<u>3.2</u>	<u>3.0</u>	<u>2.8</u>	<u>2.7</u>	<u>2.5</u>	<u>2.3</u>	<u>2.2</u>	<u>2.1</u>	<u>1.9</u>	<u>1.8</u>	<u>1.7</u>	<u>1.6</u>	<u>1.5</u>	<u>1.4</u>	<u>1.3</u>	<u>1.2</u>	<u>1.2</u>	<u>1.1</u>	<u>1.0</u>	<u>0.95</u>	<u>0.89</u>	<u>0.83</u>	<u>0.9</u>
<u>7.6</u>	<u>2.9</u>	<u>2.8</u>	<u>2.6</u>	<u>2.4</u>	<u>2.3</u>	<u>2.1</u>	<u>2.0</u>	<u>1.9</u>	<u>1.8</u>	<u>1.6</u>	<u>1.5</u>	<u>1.4</u>	<u>1.4</u>	<u>1.3</u>	<u>1.2</u>	<u>1.1</u>	<u>1.1</u>	<u>0.98</u>	<u>0.92</u>	<u>0.86</u>	<u>0.81</u>	<u>0.76</u>	<u>0.9</u>
<u>7.7</u>	<u>2.6</u>	<u>2.4</u>	<u>2.3</u>	<u>2.2</u>	<u>2.0</u>	<u>1.9</u>	<u>1.8</u>	<u>1.7</u>	<u>1.6</u>	<u>1.5</u>	<u>1.4</u>	<u>1.3</u>	<u>1.2</u>	<u>1.1</u>	<u>1.1</u>	<u>1.0</u>	<u>0.94</u>	<u>0.88</u>	<u>0.83</u>	<u>0.78</u>	<u>0.73</u>	<u>0.68</u>	<u>0.9</u>
<u>7.8</u>	<u>2.3</u>	<u>2.2</u>	<u>2.1</u>	<u>1.9</u>	<u>1.8</u>	<u>1.7</u>	<u>1.6</u>	<u>1.5</u>	<u>1.4</u>	<u>1.3</u>	<u>1.2</u>	<u>1.2</u>	<u>1.1</u>	<u>1.0</u>	<u>0.9</u> <u>5</u>	<u>0.89</u>	<u>0.84</u>	<u>0.79</u>	<u>0.74</u>	<u>0.69</u>	<u>0.65</u>	<u>0.61</u>	<u>0.9</u>
<u>7.9</u>	<u>2.1</u>	<u>1.9</u>	<u>1.8</u>	<u>1.7</u>	<u>1.6</u>	<u>1.5</u>	<u>1.4</u>	<u>1.3</u>	<u>1.2</u>	<u>1.2</u>	<u>1.1</u>	<u>1.0</u>	<u>0.95</u>	<u>0.89</u>	<u>0.8</u> <u>4</u>	<u>0.79</u>	<u>0.74</u>	<u>0.69</u>	<u>0.65</u>	<u>0.61</u>	<u>0.57</u>	<u>0.53</u>	<u>0.9</u>
<u>8.0</u>	<u>1.8</u>	<u>1.7</u>	<u>1.6</u>	<u>1.5</u>	<u>1.4</u>	<u>1.3</u>	<u>1.2</u>	<u>1.1</u>	<u>1.1</u>	<u>1.0</u>	<u>0.94</u>	<u>0.88</u>	<u>0.83</u>	<u>0.78</u>	<u>0.7</u> <u>3</u>	<u>0.68</u>	<u>0.64</u>	<u>0.60</u>	<u>0.56</u>	<u>0.53</u>	<u>0.50</u>	<u>0.44</u>	<u>0.9</u>
<u>8.1</u>	<u>1.5</u>	<u>1.5</u>	<u>1.4</u>	<u>1.3</u>	<u>1.2</u>	<u>1.1</u>	<u>1.1</u>	<u>0.99</u>	<u>0.92</u>	<u>0.87</u>	<u>0.81</u>	<u>0.76</u>	<u>0.71</u>	<u>0.67</u>	<u>0.6</u> <u>3</u>	<u>0.59</u>	<u>0.55</u>	<u>0.52</u>	<u>0.49</u>	<u>0.46</u>	<u>0.43</u>	<u>0.40</u>	<u>0.9</u>
<u>8.2</u>	<u>1.3</u>	<u>1.2</u>	<u>1.2</u>	<u>1.1</u>	<u>1.0</u>	<u>0.9</u> <u>6</u>	<u>0.90</u>	<u>0.84</u>	<u>0.79</u>	<u>0.74</u>	<u>0.70</u>	<u>0.65</u>	<u>0.61</u>	<u>0.57</u>	<u>0.5</u> <u>4</u>	<u>0.50</u>	<u>0.47</u>	<u>0.44</u>	<u>0.42</u>	<u>0.39</u>	<u>0.37</u>	<u>0.34</u>	<u>0.9</u>

<u>8.3</u>	<u>1.1</u>	<u>1.1</u>	<u>0.9</u> <u>9</u>	<u>0.9</u> <u>3</u>	<u>0.8</u> <u>7</u>	<u>0.8</u> <u>2</u>	<u>0.76</u>	<u>0.72</u>	<u>0.67</u>	<u>0.63</u>	<u>0.59</u>	<u>0.55</u>	<u>0.52</u>	<u>0.49</u>	<u>0.4</u> <u>6</u>	<u>0.43</u>	<u>0.40</u>	<u>0.38</u>	<u>0.35</u>	<u>0.33</u>	<u>0.31</u>	<u>0.29</u>	<u>0.</u>
<u>8.4</u>	<u>0.9</u> <u>5</u>	<u>0.8</u> <u>9</u>	<u>0.8</u> <u>4</u>	<u>0.7</u> <u>9</u>	<u>0.7</u> <u>4</u>	<u>0.6</u> <u>9</u>	<u>0.65</u>	<u>0.61</u>	<u>0.57</u>	<u>0.53</u>	<u>0.50</u>	<u>0.47</u>	<u>0.44</u>	<u>0.41</u>	<u>0.3</u> <u>9</u>	<u>0.36</u>	<u>0.34</u>	<u>0.32</u>	<u>0.30</u>	<u>0.28</u>	<u>0.26</u>	<u>0.25</u>	<u>0.</u>
<u>8.5</u>	<u>0.8</u> <u>0</u>	<u>0.7</u> <u>5</u>	<u>0.7</u> <u>1</u>	<u>0.6</u> <u>7</u>	<u>0.6</u> <u>2</u>	<u>0.5</u> <u>8</u>	<u>0.55</u>	<u>0.51</u>	<u>0.48</u>	<u>0.45</u>	<u>0.42</u>	<u>0.40</u>	<u>0.37</u>	<u>0.35</u>	<u>0.3</u> <u>3</u>	<u>0.31</u>	<u>0.29</u>	<u>0.27</u>	<u>0.25</u>	<u>0.24</u>	<u>0.22</u>	<u>0.21</u>	<u>0.</u>
<u>8.6</u>	<u>0.6</u> <u>8</u>	<u>0.6</u> <u>4</u>	<u>0.6</u> <u>0</u>	<u>0.5</u> <u>6</u>	<u>0.5</u> <u>3</u>	<u>0.4</u> <u>9</u>	<u>0.46</u>	<u>0.43</u>	<u>0.41</u>	<u>0.38</u>	<u>0.36</u>	<u>0.33</u>	<u>0.31</u>	<u>0.29</u>	<u>0.2</u> <u>8</u>	<u>0.26</u>	<u>0.24</u>	<u>0.23</u>	<u>0.21</u>	<u>0.20</u>	<u>0.19</u>	<u>0.18</u>	<u>0.</u>
<u>8.7</u>	<u>0.5</u> <u>7</u>	<u>0.5</u> <u>4</u>	<u>0.5</u> <u>1</u>	<u>0.4</u> <u>7</u>	<u>0.4</u> <u>4</u>	<u>0.4</u> <u>2</u>	<u>0.39</u>	<u>0.37</u>	<u>0.34</u>	<u>0.32</u>	<u>0.30</u>	<u>0.28</u>	<u>0.27</u>	<u>0.25</u>	<u>0.2</u> <u>3</u>	<u>0.22</u>	<u>0.21</u>	<u>0.19</u>	<u>0.18</u>	<u>0.17</u>	<u>0.16</u>	<u>0.15</u>	<u>0.</u>
<u>8.8</u>	<u>0.4</u> <u>9</u>	<u>0.4</u> <u>6</u>	<u>0.4</u> <u>3</u>	<u>0.4</u> <u>0</u>	<u>0.3</u> <u>8</u>	<u>0.3</u> <u>5</u>	<u>0.33</u>	<u>0.31</u>	<u>0.29</u>	<u>0.27</u>	<u>0.26</u>	<u>0.24</u>	<u>0.23</u>	<u>0.21</u>	<u>0.2</u> <u>0</u>	<u>0.19</u>	<u>0.17</u>	<u>0.16</u>	<u>0.15</u>	<u>0.14</u>	<u>0.13</u>	<u>0.13</u>	<u>0.</u>
<u>8.9</u>	<u>0.4</u> <u>2</u>	<u>0.3</u> <u>9</u>	<u>0.3</u> <u>7</u>	<u>0.3</u> <u>4</u>	<u>0.3</u> <u>2</u>	<u>0.3</u> <u>0</u>	<u>0.28</u>	<u>0.27</u>	<u>0.25</u>	<u>0.23</u>	<u>0.22</u>	<u>0.21</u>	<u>0.19</u>	<u>0.18</u>	<u>0.1</u> <u>7</u>	<u>0.16</u>	<u>0.15</u>	<u>0.14</u>	<u>0.13</u>	<u>0.12</u>	<u>0.12</u>	<u>0.11</u>	<u>0.</u>
<u>9.0</u>	<u>0.3</u> <u>6</u>	<u>0.3</u> <u>4</u>	<u>0.3</u> <u>2</u>	<u>0.3</u> <u>0</u>	<u>0.2</u> <u>8</u>	<u>0.2</u> <u>6</u>	<u>0.24</u>	<u>0.23</u>	<u>0.21</u>	<u>0.20</u>	<u>0.19</u>	<u>0.18</u>	<u>0.17</u>	<u>0.16</u>	<u>0.1</u> <u>5</u>	<u>0.14</u>	<u>0.13</u>	<u>0.12</u>	<u>0.11</u>	<u>0.11</u>	<u>0.10</u>	<u>0.09</u>	<u>0.</u>

To calculate total ammonia nitrogen chronic criteria values in freshwater when fish freshwater mussels and early life stages of fish are present at different pH and temperature values than those listed in this subsection, use the following formulas equation and round the result to two significant digits:

Chronic Criteria Concentration =

$$\left(\frac{0.0577}{(1 + 10^{7.688 - \text{pH}})} + \frac{2.487}{(1 + 10^{\text{pH} - 7.688})} \right) \times \text{MIN}$$

Where MIN = 2.85 or $1.45 \times 10^{0.028(25 - T)}$, whichever is less.

$$0.8876 \times \left(\frac{0.0278}{1 + 10^{7.688 - \text{pH}}} \pm \frac{1.1994}{1 + 10^{\text{pH} - 7.688}} \right) \times (2.126 \times 10^{0.028 \times (20 - \text{MAX}(T, 7))})$$

Where MAX = 7 or temperature in degrees Celsius, whichever is greater

T = temperature in °C

²~~The default design flow for calculating steady state waste load allocations for the chronic ammonia criterion where early life stages of fish are present is the 30Q10 (see 9VAC25-260-140 B footnote 10) unless statistically valid methods are employed which demonstrate compliance with the duration and return frequency of the water quality criteria.~~

D. Site-specific considerations and alternate criteria. If it can be adequately demonstrated that freshwater mussels or early life stages of fish are not present at a site, then alternate site-specific criteria can be considered using the information provided in this subsection. Recalculated site-specific criteria shall provide for the attainment and maintenance of the water quality standards of downstream waters.

1. Site-specific modifications to the ambient water quality criteria for ammonia to account for the absence of freshwater mussels or early life stages of fish shall be conducted in accordance with the procedures contained in this subdivision. Because the department presumes that most state waterbodies have freshwater mussels and early life stages of fish present during most times of the year, the criteria shall be calculated assuming freshwater mussels and early life stages of fish are present using subsections B and C of this section unless the following demonstration that freshwater mussels or early life stages of fish are absent is successfully completed. Determination of the absence of freshwater mussels requires special field survey methods. This determination must be made after an adequate survey of the waterbody is conducted by an individual certified by the Virginia Department of Game and Inland Fisheries (DGIF) for freshwater mussel identification and surveys. Determination of absence of freshwater mussels will be done in consultation with the DGIF. Early life stages of fish are defined in subdivision 2 of this subsection. Modifications to the ambient water quality criteria for ammonia based on the presence or absence of early life stages of fish shall only apply at temperatures below 15°C.

a. During the review of any new or existing activity that has a potential to discharge ammonia in amounts that may cause or contribute to a violation of the ammonia criteria contained in subsection B of this section, the department may examine data from the following approved sources in subdivisions 1 a (1) through (5) of this subsection or may require the gathering of data in accordance with subdivisions 1 a (1) through (5) on the presence or absence of early life stages of fish in the affected waterbody.

(1) Species and distribution data contained in the Virginia Department of Game and Inland Fisheries Wildlife Information System database.

(2) Species and distribution data contained in Freshwater Fishes of Virginia, 1994.

(3) Data and fish species distribution maps contained in Handbook for Fishery Biology, Volume 3, 1997.

(4) Field data collected in accordance with U.S. EPA's Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers, Second Edition, EPA 841-B-99-002. Field data must comply with all quality assurance and quality control criteria.

(5) The American Society for Testing and Materials (ASTM) Standard E-1241-88, Standard Guide for Conducting Early Life-Stage Toxicity Tests with Fishes.

b. If data or information from sources other than subdivisions 1 a (1) through (5) of this subsection are considered, then any resulting site-specific criteria modifications shall be

reviewed and adopted in accordance with the site-specific criteria provisions in 9VAC25-260-140 D and submitted to EPA for review and approval.

c. If the department determines that the data and information obtained from subdivisions 1 a (1) through (5) of this subsection demonstrate that there are periods of each year when no early life stages are expected to be present for any species of fish that occur at the site, the department shall issue a notice to the public and make available for public comment the supporting data and analysis along with the department's preliminary decision to authorize the site-specific modification to the ammonia criteria. Such information shall include, at a minimum:

(1) Sources of data and information.

(2) List of fish species that occur at the site as defined in subdivision 3 of this subsection.

(3) Definition of the site. Definition of a "site" can vary in geographic size from a stream segment to a watershed to an entire eco-region.

(4) Duration of early life stage for each species in subdivision 1 c (2) of this subsection.

(5) Dates when early life stages of fish are expected to be present for each species in subdivision 1 c (2) of this subsection.

(6) Based on subdivision 1 c (5) of this subsection, identify the dates (beginning date, ending date), if any, where no early life stages are expected to be present for any of the species identified in subdivision 1 c (2) of this subsection.

d. If, after reviewing the public comments received in subdivision 1 c of this subsection and supporting data and information, the department determines that there are times of the year when no early life stages are expected to be present for any fish species that occur at the site, then the applicable ambient water quality criteria for ammonia for those time periods shall be calculated using the table in this subsection, or the formula for calculating the chronic criterion concentration for ammonia when early life stages of fish are absent.

e. The department shall maintain a comprehensive list of all sites where the department has determined that early life stages of fish are absent. For each site the list will identify the waterbodies affected and the corresponding times of the year that early life stages of fish are absent. This list is available either upon request from the Office of Water Quality Programs at [629][1111] East Main Street, [Suite 1400,] Richmond, VA 23219, or from the department website at <http://www.deq.virginia.gov/programs/water/waterqualityinformationmdls/waterqualitystandards.aspx>.

2. The duration of the "early life stages" extends from the beginning of spawning through the end of the early life stages. The early life stages include the prehatch embryonic period, the post-hatch free embryo or yolk-sac fry, and the larval period, during which the organism feeds. Juvenile fish, which are anatomically similar to adults, are not considered an early life stage. The duration of early life stages can vary according to fish species. The department considers the sources of information in subdivisions 1 a (1) through (5) of this subsection to be the only acceptable sources of information for determining the duration of early life stages of fish under this procedure.

3. "Occur at the site" includes the species, genera, families, orders, classes, and phyla that are usually present at the site; are present at the site only seasonally due to migration; are present intermittently because they periodically return to or extend their ranges into the site; or were present at the site in the past or are present in nearby bodies of water, but are not currently present at the site due to degraded conditions, and are expected to return to the site when conditions improve. "Occur at the site" does not include taxa that were once present at the site but cannot exist at the site now due to permanent physical alteration of the habitat at the site.

4. Any modifications to ambient water quality criteria for ammonia in subdivision 1 of this subsection shall not likely jeopardize the continued existence of any federal or state listed, threatened, or endangered species or result in the destruction or adverse modification of such species' critical habitats.

5. Site-specific modifications to the ambient water quality criteria for ammonia to account for the absence of freshwater mussels shall be conducted in accordance with the procedures contained in this subsection. Because the department presumes that most state waterbodies have freshwater mussel species, the criteria shall be calculated assuming mussels are present using

subsections B and C of this section unless the demonstration that freshwater mussels are absent is successfully completed and accepted by DEQ and DGIF.

6. Equations for calculating ammonia criteria for four different site-specific scenarios are provided in subdivisions a through d of this subdivision 6 as follows: (i) acute criteria when mussels are absent but trout are present, (ii) acute criteria when mussels and trout are absent, (iii) chronic criteria when mussels are absent and early life stages of fish are present, and (iv) chronic criteria when mussels and early life stages of fish are absent. Additional information regarding site-specific criteria can be reviewed in appendix N (pages 225-242) of the EPA Aquatic Life Ambient Water Quality Criteria to Ammonia--Freshwater 2013 (EPA 822-R-13-001).

a. Acute criteria: freshwater mussels absent and trout present. To calculate total ammonia nitrogen acute criteria values (in mg N/L) in freshwater with freshwater mussels absent (procedures for making this determination are in subdivisions 1 through 5 of this subsection) and trout present, use the following equations. The acute criterion is the lesser of the calculation results below. Round the result to two significant digits.

$$\left(\frac{0.275}{1 + 10^{7.204 - \text{pH}}} \pm \frac{39}{1 + 10^{\text{pH} - 7.204}} \right)$$

or

$$0.7249 \times \left(\frac{0.0114}{1 + 10^{7.204 - \text{pH}}} \pm \frac{1.6181}{1 + 10^{\text{pH} - 7.204}} \right) \times (62.15 \times 10^{0.036 \times (20 - T)})$$

b. Acute criteria: freshwater mussels absent and trout absent. To calculate total ammonia nitrogen acute criteria values (in mg N/L) in freshwater where freshwater mussels are absent and trout are absent, use the following equation. Round the result to two significant digits.

$$0.7249 \times \left(\frac{0.0114}{1 + 10^{7.204 - \text{pH}}} \pm \frac{1.6181}{1 + 10^{\text{pH} - 7.204}} \right) \times \text{MIN}$$

Where MIN = 51.93 or $62.15 \times 10^{0.036 \times (20 - T)}$, whichever is less

T = Temperature in °C

~~C. The 30-day average concentration of~~ c. Chronic criteria: freshwater mussels absent and early life stages of fish present. The chronic criteria for total ammonia nitrogen (in mg N/L) where ~~early life stages of fish~~ freshwater mussels are absent (procedures for making this determination are in subdivisions 1 through 4 5 of this subsection) in freshwater shall not exceed, ~~more than once every three years on the average³, the chronic criteria below:~~ concentration values calculated using the following equation. Round the result to two significant digits.

Chronic Ammonia Freshwater Criteria
Early Life Stages of Fish Absent
Total Ammonia Nitrogen (mg N/L)

pH	Temperature (°C)									
	0-7	8	9	10	11	12	13	14	15	16
6.5	10.8	10.1	9.51	8.92	8.36	7.84	7.35	6.89	6.46	6.06
6.6	10.7	9.99	9.37	8.79	8.24	7.72	7.24	6.79	6.36	5.97
6.7	10.5	9.81	9.20	8.62	8.08	7.58	7.11	6.66	6.25	5.86
6.8	10.2	9.58	8.98	8.42	7.90	7.40	6.94	6.51	6.10	5.72
6.9	9.93	9.31	8.73	8.19	7.68	7.20	6.75	6.33	5.93	5.56
7.0	9.60	9.00	8.43	7.91	7.41	6.95	6.52	6.11	5.73	5.37
7.1	9.20	8.63	8.09	7.58	7.11	6.67	6.25	5.86	5.49	5.15
7.2	8.75	8.20	7.69	7.21	6.76	6.34	5.94	5.57	5.22	4.90
7.3	8.24	7.73	7.25	6.79	6.37	5.97	5.60	5.25	4.92	4.61
7.4	7.69	7.21	6.76	6.33	5.94	5.57	5.22	4.89	4.59	4.30

7.5	7.09	6.64	6.23	5.84	5.48	5.13	4.81	4.51	4.23	3.97
7.6	6.46	6.05	5.67	5.32	4.99	4.68	4.38	4.11	3.85	3.61
7.7	5.81	5.45	5.11	4.79	4.49	4.21	3.95	3.70	3.47	3.25
7.8	5.17	4.84	4.54	4.26	3.99	3.74	3.51	3.29	3.09	2.89
7.9	4.54	4.26	3.99	3.74	3.51	3.29	3.09	2.89	2.71	2.54
8.0	3.95	3.70	3.47	3.26	3.05	2.86	2.68	2.52	2.36	2.21
8.1	3.41	3.19	2.99	2.81	2.63	2.47	2.31	2.17	2.03	1.91
8.2	2.91	2.73	2.56	2.40	2.25	2.11	1.98	1.85	1.74	1.63
8.3	2.47	2.32	2.18	2.04	1.91	1.79	1.68	1.58	1.48	1.39
8.4	2.09	1.96	1.84	1.73	1.62	1.52	1.42	1.33	1.25	1.17
8.5	1.77	1.66	1.55	1.46	1.37	1.28	1.20	1.13	1.06	0.990
8.6	1.49	1.40	1.31	1.23	1.15	1.08	1.01	0.951	0.892	0.836
8.7	1.26	1.18	1.11	1.04	0.976	0.915	0.858	0.805	0.754	0.707
8.8	1.07	1.01	0.944	0.885	0.829	0.778	0.729	0.684	0.641	0.601
8.9	0.917	0.860	0.806	0.756	0.709	0.664	0.623	0.584	0.548	0.513
9.0	0.790	0.740	0.694	0.651	0.610	0.572	0.536	0.503	0.471	0.442

At 15°C and above, the criterion for fish early life stages absent is the same as the criterion for fish early life stages present.

To calculate total ammonia nitrogen chronic criteria values in freshwater when fish early life stages are absent at different pH and temperature values than those listed in this subsection, use the following formulas:

Chronic Criteria Concentration =

$$\left(\frac{0.0577}{(1 + 10^{7.688 - \text{pH}})} + \frac{2.487}{(1 + 10^{\text{pH} - 7.688})} \right) \times 1.45(10^{0.028(25 - \text{MAX})})$$

MAX = temperature in °C or 7, whichever is greater.

³The default design flow for calculating steady state waste load allocations for the chronic ammonia criterion where early life stages of fish are absent is the 30Q10 (see 9VAC25-260-140 B footnote 10) unless statistically valid methods are employed that demonstrate compliance with the duration and return frequency of the water quality criteria.

1. Site-specific modifications to the ambient water quality criteria for ammonia to account for the absence of early life stages of fish shall be conducted in accordance with the procedures contained in this subdivision. Because the department presumes that most state waterbodies have early life stages of fish present during most times of the year, the criteria shall be calculated assuming early life stages of fish are present using subsection B of this section unless the following demonstration that early life stages are absent is successfully completed. Early life stages of fish are defined in subdivision 2 of this subsection. Modifications to the ambient water quality criteria for ammonia based on the presence or absence of early life stages of fish shall only apply at temperatures below 15°C.

a. During the review of any new or existing activity that has a potential to discharge ammonia in amounts that may cause or contribute to a violation of the ammonia criteria contained in subsection B of this section, the department may examine data from the following approved sources in subdivisions 1 a (1) through (5) of this subsection or may require the gathering of data in accordance with subdivisions 1 a (1) through (5) on the presence or absence of early life stages of fish in the affected waterbody.

(1) Species and distribution data contained in the Virginia Department of Game and Inland Fisheries Wildlife Information System database.

(2) Species and distribution data contained in Freshwater Fishes of Virginia, 1994.

~~(3) Data and fish species distribution maps contained in Handbook for Fishery Biology, Volume 3, 1997.~~

~~(4) Field data collected in accordance with U.S. EPA's Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers, Second Edition, EPA 841-B-99-002. Field data must comply with all quality assurance/quality control criteria.~~

~~(5) The American Society for Testing and Materials (ASTM) Standard E-1241-88, Standard Guide for Conducting Early Life-Stage Toxicity Tests with Fishes.~~

~~b. If data or information from sources other than subdivisions 1 a (1) through (5) of this subsection are considered, then any resulting site-specific criteria modifications shall be reviewed and adopted in accordance with the site-specific criteria provisions in 9VAC25-260-140 D, and submitted to EPA for review and approval.~~

~~c. If the department determines that the data and information obtained from subdivisions 1 a (1) through (5) of this subsection demonstrate that there are periods of each year when no early life stages are expected to be present for any species of fish that occur at the site, the department shall issue a notice to the public and make available for public comment the supporting data and analysis along with the department's preliminary decision to authorize the site-specific modification to the ammonia criteria. Such information shall include, at a minimum:~~

~~(1) Sources of data and information.~~

~~(2) List of fish species that occur at the site as defined by subdivision 3 of this subsection.~~

~~(3) Definition of the site. Definition of a "site" can vary in geographic size from a stream segment to a watershed to an entire eco-region.~~

~~(4) Duration of early life stage for each species in subdivision 1 c (2) of this subsection.~~

~~(5) Dates when early life stages of fish are expected to be present for each species in subdivision 1 c (2) of this subsection.~~

~~(6) Based on subdivision 1 c (5) of this subsection, identify the dates (beginning date, ending date), if any, where no early life stages are expected to be present for any of the species identified in subdivision 1 c (2) of this subsection.~~

~~d. If, after reviewing the public comments received in subdivision 1 c of this subsection and supporting data and information, the department determines that there are times of the year where no early life stages are expected to be present for any fish species that occur at the site, then the applicable ambient water quality criteria for ammonia for those time periods shall be calculated using the table in this subsection, or the formula for calculating the chronic criterion concentration for ammonia when fish early life stages are absent.~~

~~e. The department shall maintain a comprehensive list of all sites where the department has determined that early life stages of fish are absent. For each site the list will identify the waterbodies affected and the corresponding times of the year that early life stages are absent. This list is available either upon request from the Office of Water Quality Programs at P.O. Box 1105, Richmond, Virginia 23218 or from the department website <http://www.deq.virginia.gov/wqs>.~~

~~2. The duration of the "early life stages" extends from the beginning of spawning through the end of the early life stages. The early life stages include the prehatch embryonic period, the post-hatch free embryo or yolk-sac fry, and the larval period, during which the organism feeds. Juvenile fish, which are anatomically similar to adults, are not considered an early life stage. The duration of early life stages can vary according to fish species. The department considers the sources of information in subdivisions 1 a (1) through (5) of this subsection to be the only acceptable sources of information for determining the duration of early life stages of fish under this procedure.~~

~~3. "Occur at the site" includes the species, genera, families, orders, classes, and phyla that: are usually present at the site; are present at the site only seasonally due to migration; are present intermittently because they periodically return to or extend their ranges into the site; were present at the site in the past or are present in nearby bodies of water, but are not currently present at the site due to degraded conditions, and are expected to return to the site when conditions improve. "Occur at the site" does not include taxa that were once present at the site but cannot exist at the site now due to permanent physical alteration of the habitat at the site.~~

~~4. Any modifications to ambient water quality criteria for ammonia in subdivision 1 of this subsection shall not likely jeopardize the continued existence of any federal or state listed, threatened or endangered species or result in the destruction or adverse modification of such species' critical habitat.~~

$$0.9405 \times \left(\frac{0.0278}{1 + 10^{7.688 - \text{pH}}} \pm \frac{1.1994}{1 + 10^{\text{pH} - 7.688}} \right) \times \text{MIN}$$

Where MIN = 6.920 or $7.547 \times 10^{0.028 \times (20 - T)}$ whichever is less

T = temperature in °C

d. Chronic criteria: freshwater mussels absent and early life stages of fish absent. The chronic criteria for total ammonia nitrogen (in mg N/L) where freshwater mussels are absent and early life stages of fish are absent (procedures for making this determination are in subdivisions 1 through 5 of this subsection) in freshwater shall not exceed concentration values calculated using the following equation. Round the result to two significant digits.

$$0.9405 \times \left(\frac{0.0278}{1 + 10^{7.688 - \text{pH}}} \pm \frac{1.1994}{1 + 10^{\text{pH} - 7.688}} \right) \times (7.547 \times 10^{0.028 \times (20 - \text{MAX}(T, 7))})$$

Where MAX = 7 or temperature in degrees Celsius, whichever is greater

T = temperature in °C

~~D.~~ E. The one-hour average concentration of total ammonia nitrogen (in mg N/L) in saltwater shall not exceed, more than once every three years on the average, the acute criteria below:

Acute Ammonia Saltwater Criteria Total Ammonia Nitrogen (mg N/L) Salinity = 10 g/kg								
pH	Temperature °C							
	0	5	10	15	20	25	30	35
7.00	231.9	159.8	110.1	75.88	52.31	36.08	24.91	17.21
7.20	146.4	100.9	69.54	47.95	33.08	22.84	15.79	10.93
7.40	92.45	63.73	43.94	30.32	20.94	14.48	10.03	6.97
7.60	58.40	40.28	27.80	19.20	13.28	9.21	6.40	4.47
7.80	36.92	25.48	17.61	12.19	8.45	5.88	4.11	2.89
8.00	23.37	16.15	11.18	7.76	5.40	3.78	2.66	1.89
8.20	14.81	10.26	7.13	4.97	3.48	2.46	1.75	1.27
8.40	9.42	6.54	4.57	3.20	2.27	1.62	1.18	0.87
8.60	6.01	4.20	2.95	2.09	1.50	1.09	0.81	0.62
8.80	3.86	2.72	1.93	1.39	1.02	0.76	0.58	0.46
9.00	2.51	1.79	1.29	0.95	0.71	0.55	0.44	0.36

Salinity = 20 g/kg

pH	Temperature °C							
	0	5	10	15	20	25	30	35
7.00	247.6	170.5	117.5	80.98	55.83	38.51	26.58	18.36
7.20	156.3	107.7	74.21	51.17	35.30	24.37	16.84	11.66
7.40	98.67	68.01	46.90	32.35	22.34	15.44	10.70	7.43
7.60	62.33	42.98	29.66	20.48	14.17	9.82	6.82	4.76
7.80	39.40	27.19	18.78	13.00	9.01	6.26	4.37	3.07
8.00	24.93	17.23	11.92	8.27	5.76	4.02	2.83	2.01
8.20	15.80	10.94	7.59	5.29	3.70	2.61	1.86	1.34
8.40	10.04	6.97	4.86	3.41	2.41	1.72	1.24	0.91
8.60	6.41	4.47	3.14	2.22	1.59	1.15	0.85	0.65
8.80	4.11	2.89	2.05	1.47	1.07	0.80	0.61	0.48
9.00	2.67	1.90	1.36	1.00	0.75	0.57	0.46	0.37

Salinity = 30 g/kg

pH	Temperature °C							
	0	5	10	15	20	25	30	35
7.00	264.6	182.3	125.6	86.55	59.66	41.15	28.39	19.61
7.20	167.0	115.1	79.31	54.68	37.71	26.03	17.99	12.45
7.40	105.5	72.68	50.11	34.57	23.87	16.50	11.42	7.92
7.60	66.61	45.93	31.69	21.88	15.13	10.48	7.28	5.07
7.80	42.10	29.05	20.07	13.88	9.62	6.68	4.66	3.27
8.00	26.63	18.40	12.73	8.83	6.14	4.29	3.01	2.13
8.20	16.88	11.68	8.10	5.64	3.94	2.78	1.97	1.42
8.40	10.72	7.44	5.18	3.63	2.56	1.82	1.31	0.96
8.60	6.83	4.77	3.34	2.36	1.69	1.22	0.90	0.68
8.80	4.38	3.08	2.18	1.56	1.13	0.84	0.64	0.50
9.00	2.84	2.01	1.45	1.06	0.79	0.60	0.47	0.39

To calculate total ammonia nitrogen acute criteria values in saltwater at different pH and temperature values than those listed in this subsection, use the following formulas:

$$I = \frac{19.9273S}{(1000 - 1.005109S)}$$

Where I = molal ionic strength of water

S = Salinity ppt (g/kg)

The regression model used to relate I to pKa (negative log of the ionization constant) is

$$pK_a = 9.245 + 0.138(I)$$

pKa as defined by these equations is at 298 degrees Kelvin (25°C). T °Kelvin = °C + 273

To correct for other temperatures:

$$pK_a^S_T = pK_a^S_{298} + 0.0324(298 - T \text{ °Kelvin})$$

The unionized ammonia fraction (UIA) is given by:

$$UIA = \frac{1}{1 + 10^{pH - pK_a^S_T}}$$

$$1 + 10^{(pK_{aT} - pH)}$$

The acute ammonia criterion in saltwater is given by:

$$\text{Acute} = \frac{0.233}{\text{UIA}}$$

Multiply the acute value by 0.822 to get the ammonia-N acute criterion.

~~E. F.~~ The 30-day average concentration of total ammonia nitrogen (in mg N/L) in saltwater shall not exceed, more than once every three years on the average, the chronic criteria below:

Chronic Ammonia Saltwater Criteria Total Ammonia Nitrogen (mg N/L) Salinity = 10 g/kg								
pH	Temperature °C							
	0	5	10	15	20	25	30	35
7.00	34.84	24.00	16.54	11.40	7.86	5.42	3.74	2.59
7.20	21.99	15.15	10.45	7.20	4.97	3.43	2.37	1.64
7.40	13.89	9.57	6.60	4.55	3.15	2.18	1.51	1.05
7.60	8.77	6.05	4.18	2.88	2.00	1.38	0.96	0.67
7.80	5.55	3.83	2.65	1.83	1.27	0.88	0.62	0.43
8.00	3.51	2.43	1.68	1.17	0.81	0.57	0.40	0.28
8.20	2.23	1.54	1.07	0.75	0.52	0.37	0.26	0.19
8.40	1.41	0.98	0.69	0.48	0.34	0.24	0.18	0.13
8.60	0.90	0.63	0.44	0.31	0.23	0.16	0.12	0.09
8.80	0.58	0.41	0.29	0.21	0.15	0.11	0.09	0.07
9.00	0.38	0.27	0.19	0.14	0.11	0.08	0.07	0.05

Salinity = 20 g/kg

pH	Temperature °C							
	0	5	10	15	20	25	30	35
7.00	37.19	25.62	17.65	12.16	8.39	5.78	3.99	2.76
7.20	23.47	16.17	11.15	7.69	5.30	3.66	2.53	1.75
7.40	14.82	10.22	7.04	4.86	3.36	2.32	1.61	1.12
7.60	9.36	6.46	4.46	3.08	2.13	1.47	1.02	0.71
7.80	5.92	4.08	2.82	1.95	1.35	0.94	0.66	0.46
8.00	3.74	2.59	1.79	1.24	0.86	0.60	0.43	0.30
8.20	2.37	1.64	1.14	0.79	0.56	0.39	0.28	0.20
8.40	1.51	1.05	0.73	0.51	0.36	0.26	0.19	0.14
8.60	0.96	0.67	0.47	0.33	0.24	0.17	0.13	0.10
8.80	0.62	0.43	0.31	0.22	0.16	0.12	0.09	0.07
9.00	0.40	0.28	0.20	0.15	0.11	0.09	0.07	0.06

Salinity = 30 g/kg

pH	Temperature °C							
	0	5	10	15	20	25	30	35

7.00	39.75	27.38	18.87	13.00	8.96	6.18	4.27	2.95
7.20	25.09	17.29	11.91	8.21	5.67	3.91	2.70	1.87
7.40	15.84	10.92	7.53	5.19	3.59	2.48	1.72	1.19
7.60	10.01	6.90	4.76	3.29	2.27	1.57	1.09	0.76
7.80	6.32	4.36	3.01	2.08	1.44	1.00	0.70	0.49
8.00	4.00	2.76	1.91	1.33	0.92	0.64	0.45	0.32
8.20	2.53	1.75	1.22	0.85	0.59	0.42	0.30	0.21
8.40	1.61	1.12	0.78	0.55	0.38	0.27	0.20	0.14
8.60	1.03	0.72	0.50	0.35	0.25	0.18	0.14	0.10
8.80	0.66	0.46	0.33	0.23	0.17	0.13	0.10	0.08
9.00	0.43	0.30	0.22	0.16	0.12	0.09	0.07	0.06

To calculate total ammonia nitrogen chronic criteria values in saltwater at different pH and temperature values than those listed in this subsection, use the following formulas:

$$I = \frac{19.9273S}{(1000 - 1.005109S)}$$

Where I = molal ionic strength of water

S = Salinity ppt (g/kg)

The regression model used to relate I to pKa (negative log of the ionization constant) is

$$pK_a = 9.245 + 0.138(I)$$

pKa as defined by these equations is at 298 degrees Kelvin (25°C). T °Kelvin = °C + 273

To correct for other temperatures:

$$pK_a^S_T = pK_a^S_{298} + 0.0324(298 - T \text{ °Kelvin})$$

The unionized ammonia fraction (UIA) is given by:

$$UIA = \frac{1}{1 + 10^{(pK_a^S_T - pH)}}$$

The chronic ammonia criterion in saltwater is given by:

$$\text{Chronic} = \frac{0.035}{UIA}$$

Multiply the chronic value by 0.822 to get the ammonia-N chronic criterion.

¹The default design flow for calculating steady state wasteload allocations for the acute ammonia criterion for freshwater is the 1Q10 (see 9VAC25-260-140 B footnote [19][6]) unless statistically valid methods are employed which demonstrate compliance with the duration and return frequency of the water quality criteria.

²The default design flow for calculating steady state wasteload allocations for the chronic ammonia criterion for freshwater is the 30Q10 (see 9VAC25-260-140 B footnote [19][6]) unless statistically valid methods are employed which demonstrate compliance with the duration and return frequency of the water quality criteria.

~~G. [Implementation of ammonia criteria through Virginia Pollutant Discharge Elimination System (VPDES) Permits. The ammonia criteria in subsections A, B, and C of this section shall be addressed during individual VPDES permit reissuance for existing dischargers subject to new or more restrictive water quality-based ammonia effluent limits in accordance with the department's standard permitting practices except as follows:~~

~~1. Notwithstanding any other regulatory requirement, a compliance schedule may be established that exceeds the term of the permit, subject to a demonstration by the permittee that a longer period is necessary to allow a reasonable opportunity to attain compliance with the new or more restrictive ammonia discharge requirements. The department's consideration for such a demonstration shall be~~

~~made on a case-by-case basis and shall require compliance as soon as possible, but not later than the applicable statutory deadline under the Clean Water Act.~~

~~2. Information to be provided under subdivision 1 of this subsection may include such factors as (i) opportunities to minimize costs to the public or facility owners by phasing in the implementation of multiple projects, (ii) time needed for freshwater mussel habitat determinations, and (iii) other relevant factors.~~

~~3. If a permit establishes a schedule of compliance that exceeds the term of the permit, the compliance schedule shall set forth interim requirements and the dates for their achievement.~~

~~a. The time between interim dates shall not exceed one year.~~

~~b. If the time necessary for completion of any interim requirement is more than one year and is not readily divisible into stages for completion, the permit shall specify interim dates for the submission of reports of progress toward completion of the interim requirements and indicate a projected completion date.~~

~~c. The permit shall be written to require that no later than 14 days following each interim date and the final date of compliance, the permittee shall notify the department in writing of its compliance or noncompliance with the interim or final requirements, or submit progress reports if subdivision 3 b of this subsection is applicable.~~

~~d. Any change to an interim compliance date in the schedule of compliance will be deemed to be a minor modification of the permit, provided the new date is not more than 120 days after the date specified in the existing permit and does not interfere with attainment of the final compliance date requirement.]~~

[Implementation of Freshwater Ammonia Criteria in subsections B and C through VPDES Permits issued pursuant to 9VAC25-31 - Virginia Pollutant Discharge Elimination System (VPDES) Permit Regulation.

1. The above criteria in subsections B and C shall be implemented in VPDES permits that are being reissued in accordance with the following schedule:

- a. Major municipal with design flows greater than or equal to 5 million gallons per day and major industrial facilities – **12 months following the WQS effective date**
- b. Municipal facilities with design flows greater than or equal to 500,000 gallons per day and less than 5 million gallons per day and all minor industrial facilities – **24 months following the WQS effective date.**
- c. Minor municipal facilities with design flows that are less than 500,000 gallons per day – **36 months following the WQS effective date.**

2. VPDES permits shall not be revoked and reissued to avoid or delay being subject to the freshwater ammonia criteria in subsections B and C in accordance with the above schedule.

3. The provisions of 9 VAC 25-31-250.A.3 notwithstanding, a permittee may request and the board may authorize, as appropriate, an extended schedule of compliance, which exceeds the term of the VPDES permit and may include multiple permit cycles to achieve effluent limits based on the freshwater ammonia water quality criteria in subsections B and C.

- a. Any extended schedule of compliance necessary for the implementation of the freshwater ammonia criteria shall require compliance as soon as possible in accordance with 9 VAC 25-31-250.A.1. The board may consider the following factors on a case-by-case basis, relying on information provided by the permittee, in making a determination of “as soon as possible”:
 - i. The relative priority of ammonia criteria and other water quality and water infrastructure needs of the local community or permittee.
 - ii. Availability of grant funding pursuant to VA Code § 10.1-2131 and other treatment facility expansion and upgrade plans.

- iii. Whether an extended schedule of compliance is appropriate for facilities or classes of facilities, and
 - iv. Appropriate mechanisms to address affordability limitations and financial hardship situations remaining notwithstanding parts i through iii above.
- b. Any request by the permittee for an extended schedule of compliance shall include at the time of permit application the following information at a minimum:
- i. Documentation of other water quality and water infrastructure projects that are in the planning, design or construction process and the relative priority of the projects in relation to compliance with the ammonia criteria.
 - ii. A preliminary engineering analysis of treatment facility upgrade or source reduction alternatives necessary to meet the freshwater ammonia criteria. The analysis may include any additional upgrade or expansion plans currently under consideration. The analysis shall be prepared by a professional engineer registered in Virginia and shall include an estimation of the capital and operations and maintenance costs.
 - iii. An assessment of project affordability and identification of all potential sources of funding for enhanced ammonia treatment. In the case of publicly owned treatment works, include an evaluation of the required sewer use fees versus median household income.
 - iv. Documentation that demonstrates the minimum estimated time required and schedule to design, fund and construct the selected treatment or source reduction alternative.
 - v. An evaluation, prepared by a professional engineer registered in Virginia, of the highest achievable condition (HAC) regarding nitrification capabilities of the existing treatment facility under the influent loading conditions expected during the term of the VPDES permit as well as under design loading conditions.
- c. Any VPDES permit that authorizes an extended schedule of compliance for meeting the freshwater ammonia criteria that exceeds the permit term shall include interim effluent limitations based on the HAC attainable during the term of the permit, final effluent limitations and a final compliance date.
- d. New dischargers defined in 9VAC25-31 are not eligible for extended schedules of compliance under this section; however, they remain eligible for schedules of compliance consistent with 9VAC25-31-250.

A permittee may seek a site-specific modification or variance to the freshwater ammonia water quality criteria under 9VAC25-260-140.D, or 9VAC25-260-140.E as applicable.]

ATTACHMENT 3: Full text of proposed Phased Implementation Program
[Changes since proposed shown in **red** and ~~strikethrough~~]

9VAC25-260-155

G. Implementation of Freshwater Ammonia Criteria in subsections B and C through VPDES Permits issued pursuant to 9VAC25-31 - Virginia Pollutant Discharge Elimination System (VPDES) Permit Regulation.

1. The above criteria in subsections B and C shall be implemented in VPDES permits that are being reissued in accordance with the following schedule:
 - a. Major municipal [**with design flows greater than or equal to 5 million gallons per day**] and [**major**] industrial facilities – [**612**] months following the **WQS effective date**
 - b. M~~inor m~~unicipal facilities with design flows greater than or equal to [~~400~~**500**,000] gallons per day and less than [~~4~~**5**] million gallons per day and all minor industrial facilities – [~~18~~**24**] months following the **WQS effective date**.
 - c. Minor municipal facilities with design flows that are less than [~~400~~**500**,000] gallons per day – [~~30~~**36**] months following the **WQS effective date**.
2. VPDES permits shall not be revoked and reissued to avoid or delay being subject to the freshwater ammonia criteria in subsections B and C in accordance with the above schedule.
3. The provisions of 9 VAC 25-31-250.A.3 notwithstanding, a permittee may request and the board may authorize, as appropriate, an extended schedule of compliance, which exceeds the term of the VPDES permit and may include multiple permit cycles to achieve effluent limits based on the freshwater ammonia water quality criteria in subsections B and C.
 - a. Any extended schedule of compliance necessary for the implementation of the freshwater ammonia criteria shall require compliance as soon as possible in accordance with 9 VAC 25-31-250.A.1. The board may consider the following factors on a case-by-case basis, relying on information provided by the permittee, in making a determination of “as soon as possible”:
 - i. The relative priority of ammonia criteria and other water quality and water infrastructure needs of the local community [**or permittee**].
 - ii. Availability of grant funding pursuant to VA Code § 10.1-2131 and other treatment facility expansion and upgrade plans,
 - iii. Whether an extended schedule of compliance is appropriate for facilities or classes of facilities, and
 - iv. Appropriate mechanisms to address affordability limitations and financial hardship situations remaining notwithstanding parts i through iii above.
 - b. Any request by the permittee for an extended schedule of compliance shall include at the time of permit application the following information at a minimum:
 - i. Documentation of other water quality and water infrastructure projects that are in the planning, design or construction process and the relative priority of the projects in relation to compliance with the ammonia criteria.
 - ii. A preliminary engineering analysis of treatment facility upgrade [**or source**

- reduction] alternatives necessary to meet the freshwater ammonia criteria. The analysis may include any additional upgrade or expansion plans currently under consideration. The analysis shall be prepared by a professional engineer registered in Virginia and shall include an estimation of the capital and operations and maintenance costs.
- iii. An assessment of project affordability [~~including an evaluation of the required sewer use fees versus median household income~~] and identification of all potential sources of funding for enhanced ammonia treatment. [In the case of publicly owned treatment works, include an evaluation of the required sewer use fees versus median household income].
 - iv. Documentation that demonstrates the minimum estimated time required and schedule to design, fund and construct the selected treatment [or source reduction alternative].
 - v. An evaluation, prepared by a professional engineer registered in Virginia, of the highest achievable condition (HAC) regarding nitrification capabilities of the existing treatment facility under the influent loading conditions expected during the term of the VPDES permit as well as under design loading conditions.
- c. Any VPDES permit that authorizes an extended schedule of compliance for meeting the freshwater ammonia criteria that exceeds the permit term shall include interim effluent limitations based on the HAC attainable during the term of the permit, final effluent limitations and a final compliance date.
 - d. New dischargers defined in 9VAC25-31 are not eligible for extended schedules of compliance under this section; however, they remain eligible for schedules of compliance consistent with 9VAC25-31-250.
4. A permittee may seek a site-specific modification or variance to the freshwater ammonia water quality criteria under 9VAC25-260-140.D, or 9VAC25-260-140.E as applicable.]

ATTACHMENT 4: List of commenters; Aug. 6 – Oct. 5, 2018 Public Review period

Localities/Service Authorities:

Alexandria Renew Enterprises
Amelia County
Amherst County Service Authority
Augusta County Service Authority
Bath County Service Authority
Chesterfield County Department of Public Utilities
Town of Christiansburg
Town of Culpeper
City of Danville Department of Public Utilities
Fauquier County Water and Sanitation Authority
Frederick Water
Halifax County Service Authority
Town of Hamilton
Hampton Roads Sanitation District
Hanover County
Harrisonburg-Rockingham Regional Sewer Authority
Henrico County Department of Public Utilities
Hopewell Water Renewal
Town of Keysville
Town of Kilmarnock
Town of Lawrenceville
Lee County Public Service Authority
Town of Leesburg
Loudoun Water
Louisa County Water Authority
Town of Luray
City of Lynchburg – Water Resources
Town of Marion
Maury Service Authority
Town of Middleton
Pepper's Ferry Regional Wastewater Treatment Authority
Powhatan County
Rapidan Service Authority
City of Richmond
Shenandoah County
Stafford County
Tazewell County Public Service Authority
Washington County
City of Winchester

Representative Organizations:

Virginia Association of Municipal Wastewater Agencies (VAMWA)
Virginia Manufacturers Association (VMA)
Virginia Rural Water/Virginia Water & Wastewater Authorities Association

Environmental Organizations/Federal Agencies:

Chesapeake Bay Foundation (CBF)/James River Association (JRA)
U.S. Environmental Protection Agency (EPA)

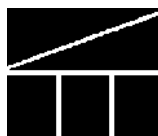
Business/citizen:

Appalachian Power Company (APCo)
Bill Randall
White Tail Resort

Attachment 5

Adverse impact notification sent to Joint Commission on Administrative Rules, House Committee on Appropriations, and Senate Committee on Finance (COV § 2.2-4007.04.C): Yes ☒ Not Needed ☐

If/when this economic impact analysis (EIA) is published in the *Virginia Register of Regulations*, notification will be sent to each member of the General Assembly (COV § 2.2-4007.04.B).



Virginia Department of Planning and Budget **Economic Impact Analysis**

9 VAC 25-260 Water Quality Standards
Department of Environmental Quality
Town Hall Action/Stage: 3171/5343
June 16, 2017

Summary of the Proposed Amendments to Regulation

The State Water Control Board (Board) proposes to adopt the most recent water quality standards recommended by the United States Environmental Protection Agency (EPA) for ammonia and cadmium criteria for protection of aquatic life; 94 chemical pollutant criteria, and the bacteria criteria and assessment methodology for protection of human health.

Result of Analysis

The proposed regulation may introduce substantial costs (possibly over one-half billion dollars) on affected point sources and will likely benefit aquatic life and human health. The costs that potentially impacted dischargers might have to spend on treatment upgrades to meet more stringent criteria depend on individual permit requirements that are site-specific and variable. As a result, there is insufficient data to accurately compare the magnitude of the benefits versus the costs. Detailed analysis of the benefits and costs are in the next section.

Estimated Economic Impact

This regulation establishes water quality standards for surface waters of the Commonwealth. Criteria are based on the maximum acceptable amount of pollutants, that directly affect aquatic life and /or human health, that can be discharged into receiving waters and not exceed criteria protective of designated uses. Federal and state mandates in the Clean Water

Act at §303(c), 40 CFR 131 and the Code of Virginia in §62.1-44.15(3a) require that these water quality standards be evaluated every three years. In addition, §303(a) of the Clean Water Act requires the EPA to develop and publish water quality criteria that reflect the latest scientific knowledge. EPA recommendations are purely based on protection of aquatic life and human health and do not reflect consideration of economic impacts or the technological feasibility of meeting pollutant concentrations in ambient water. These criteria are not rules, nor do they automatically become part of a state's water quality standards. States may adopt the criteria that the EPA publishes, modify the EPA's criteria to reflect site-specific conditions, or adopt different criteria based on other scientifically defensible methods. The EPA must approve any new water quality standards adopted by a state before they can be used for Clean Water Act purposes. Should a state fail to update its standards, the EPA may adopt and enforce water quality criteria on behalf of the state. In this action, the Board proposes to adopt the most recent water quality standards recommended by the EPA. Once adopted, these criteria become the basis of establishing permit limits and Total Maximum Daily Loads (TMDLs).

Freshwater Ammonia Criteria for Protection of Aquatic Life

In 2013, the EPA updated its 1999 recommendations for ambient freshwater ammonia criteria to reflect the newly discovered sensitive nature of freshwater mussels and snails to ammonia toxicity. According to the EPA¹ “Freshwater mussels are highly sensitive to ammonia toxicity and represent the most sensitive species in the dataset for the criteria recommendations. New science has demonstrated that freshwater snails are also sensitive to ammonia toxicity. Both mussels and snails are important to the environment because they serve as food sources for other organisms in the food web and provide vital services in improving and maintaining water quality. Specifically, mussels are filter feeders and can filter nutrients, toxics, and other pollutants out of the water, thereby helping to control the levels of these pollutants and reduce exposure to humans and other aquatic organisms. Snails feed on organic debris including algae, which helps to reduce the effects of eutrophication and keeps bottom substrates clean for other benthic organisms.”

The allowable total ammonia nitrogen level depends on several factors (i.e. whether it is for acute or chronic levels, whether trout are absent or present, various combinations of pH and

¹ <https://www.epa.gov/sites/production/files/2015-08/documents/flexibilities-for-states-applying-epa-s-ammonia-criteria-recommendations.pdf>

temperature levels, whether mussels and early life stages of fish are absent or present). Thus, the proposed regulation contains hundreds of ammonia criteria in tables for various combinations of the relevant factors. The proposed ammonia criteria are more stringent than the current limits by a factor of between 2.2 times and 5.9 times for all possible combinations of pH and temperature. However, the proposed criteria are about twice as stringent as the current criteria based on an assumed pH of 7 and temperature of 20 degrees Celsius. Criteria that are more stringent can result in more stringent effluent limits for Virginia Pollutant Discharge Elimination System (VPDES) permitted dischargers. Those sources with monitoring requirements in their permit may also be affected if their discharges have the potential to exceed the proposed ammonia criteria. According to DEQ, the estimated number of potentially affected facilities due to the proposed amendments to the ammonia criteria is 370 and includes those facilities with effluent limitations and those with monitoring requirements but no limits.

The primary and most widespread potential cost increase associated with all of the proposed amendments in this action would be from meeting more stringent ammonia limits for municipal dischargers to comply with the revised ammonia criteria. A permit holder may reduce the ammonia discharge through nitrification, which would convert ammonia into nitrate-nitrogen and then discharge nitrate into the water. If nitrate cannot be discharged into the water because of permit limits, then the facility may install a nitrification/denitrification system, convert nitrate-nitrogen from the first step into the harmless gas form of nitrogen, and discharge into the air instead of water.

The facilities most likely to be affected are those in the Chesapeake Bay watershed with design flows less than 0.1 million gallons/day (MGD) located east of Interstate 95 and those with design flows less than 0.5 MGD west of I-95. Permittees with discharges outside of the Bay watershed, particularly those facilities that are large in volume compared to the receiving stream, may also have similar potential financial impacts.

According to DEQ, there are approximately 220 discharge permits issued in the Chesapeake Bay watershed with either ammonia limits or ammonia monitoring requirements. Although ammonia limits or monitoring requirements are part of the permits, it may be assumed those facilities with ammonia limits east of Interstate 95 with a design flow equal to or greater than 0.1 MGD and those with ammonia limits west of I-95 with a design flow equal to or greater

than 0.5 MGD either currently have ammonia control requirements or will be required to nitrify/denitrify to comply with the total nitrogen waste load allocations of the Water Quality Planning Management Regulation (9VAC25-720 et seq) and the Chesapeake Bay Watershed General Permit Regulation for Total Nitrogen and Total Phosphorus Discharges and Nutrient Trading (9VAC25-820). DEQ believes that those facilities utilizing a nitrification/denitrification wastewater treatment process to meet total nitrogen concentration limits greatly reduce the ammonia concentrations in effluent to very low levels and consequently will most likely meet the more stringent ammonia criteria without additional effort.

There are approximately 20 facilities east of Interstate 95 with flows less than 0.1 MGD. It is anticipated that these facilities have the greatest likelihood to incur impacts due to more stringent ammonia criteria. Of these, 17 now have numeric ammonia limits and it is likely they have nitrification capability to meet current limits. However, an upgrade and/or operational procedure modification may be necessary to comply with newer, more stringent ammonia limits.

There are approximately 119 facilities west of I-95 with design flows less than 0.5 MGD. It is anticipated that these facilities have the greatest likelihood to incur impacts due to more stringent ammonia criteria. All but 2 have numeric ammonia limits now and it is likely that the facilities with numeric limits have nitrification capability to meet current limits; however, an upgrade and/or operational procedure modification may be necessary to comply with newer, more stringent ammonia limits. It is unknown how many of these would install a simple nitrification system or an advanced nitrification/denitrification system.

There are approximately 150 discharge permits issued outside of the Chesapeake Bay watershed with either ammonia limits or ammonia monitoring requirements. It is possible that those with only monitoring requirements will incur costs should more stringent effluent limits be necessary. All but 8 have numeric ammonia limits now and it is likely these facilities have nitrification capability to meet current limits; however, an upgrade and/or operational procedure modification may be necessary to comply with newer, more stringent ammonia limits.

DEQ estimates that a simple nitrification system costs about \$372,000 for a 0.10 MGD sewage treatment plant. The cost of an advanced treatment system capable of both nitrification and denitrification can range from \$750,000 to \$8,195,000 depending on the current level of treatment and volume of discharge. These costs are one-time capital expenditures and are

unlikely to recur during the useful life of the equipment; however, operations and maintenance costs would be ongoing. Operations and maintenance costs for nitrification/denitrification could be \$23,000/a year for a 0.10-MGD plant to \$195,000/a year for a 0.60-MGD plant.

As an example, for a totally new 0.7 MGD plant, roughly 50% of the cost of the new oxidation ditch, and 100% of the submerged diffused outfall, etc., is attributed to the cost for ammonia removal. In this case, roughly 9% of the total cost can be attributed to ammonia removal or roughly \$500,000 of the \$5,655,000 construction bid price.

In another example, a facility design flow upgrade from 4.0 to 6.5 MGD, the cost attributable to ammonia removal, is more complicated because the oxidation ditch volume is set, with no expansion of the aerator volume, but there is a hydraulic increase of the overall facility. Roughly, 30% of the aeration system, filter, and digester upgrade costs, and 100% of the integrated fixed-film activated sludge costs are attributable to ammonia removal. This adds up to about \$1,720,700 or approximately 13% of the overall bid price of \$13,278,600. It is estimated the cost per gallon of ammonia removal in the examples given above for the new construction is \$0.71/gallon and cost per gallon for the upgrade is \$0.26/gallon.

The Virginia Association of Municipal Wastewater Agencies (VAMWA) has prepared an estimate of economic impact of the proposed ammonia criteria on its members and other sewage treatment facilities. Utilizing the capital and operating and maintenance costs estimated by the EPA for various design ranges, the VAMWA's study estimates that capital costs will reach \$512.3 million and ongoing operating and maintenance costs will be \$33.6 million per year for 490 affected facilities in 2014 dollars. These costs are expected to be distributed over a 10-year period as VPDES permits are reissued with compliance schedules. The study projects much higher relative costs for smaller facilities such as schools and public rest stops compared to larger facilities. The VAMWA estimate does not address upgrades and costs for commercial or industrial facilities with direct discharge permits, upgrades and costs for pretreatment that public treatment facilities may require of commercial and industrial facilities that discharge into public collection systems, and development and implementation costs of TMDLs for additional waters that may be listed for aquatic life impairment as a result of more stringent criteria.

A TMDL is a plan to improve the quality of an impaired water body. Development of TMDLs requires significant amounts of labor to collect data, to determine land uses, animal

densities, crop densities, the number of septic systems, contributions from point and nonpoint sources, and construction of a simulation model. DEQ usually incurs the development costs, but some funding is provided from the federal government. Implementation of a TMDL may represent significant costs to pollution sources as well. For example, fencing may be required to prevent direct deposition into water from cattle, a buffer area may be needed to function as a filter for agricultural runoff, and failing septic systems may have to be fixed. In addition to these, the implementation involves public participation, and staff travel which add to the overall costs. There are various cost share and incentive programs for TMDL implementation. The magnitude of TMDL costs varies from project to project and is pollutant specific. For example, the cost of a bacteria TMDL project costs range from \$41,000 to \$145,000.

According to DEQ, there is currently one outstanding aquatic life use impairment attributed to ammonia that has yet to be prioritized. There are no ammonia related TMDLs at this time. However given the more stringent values proposed by this regulation, that situation could change. DEQ does not know the potential impact of this change on development and implementation costs of TMDLs because a TMDL determination is site specific.

There appears to be general consensus that the proposed ammonia criteria may have a substantial economic impact particularly on smaller facilities. In addition, there appears to be a general agreement on the unit cost estimates provided above for various facility design sizes. However, there appears to be a difference of opinion on how many facilities will be able to meet the proposed criteria without having to build a new facility or upgrade. For example, the VAMWA study presumes that a substantial number of major Chesapeake Bay watershed facilities that currently nitrify will not be able to meet permit limits while DEQ believes that they will.

The EPA allows certain flexibilities in adopting water quality criteria. For example, states are allowed to adopt site-specific criteria to take into account absence or presence of sensitive species. After consultation with the Virginia Department of Game and Inland Fisheries, Virginia Department of Conservation and Recreation, and United States Fish and Wildlife Service, the Board concluded that it would assume the presence of freshwater mussels in any perennial freshwater stream in Virginia but does propose to allow point sources to demonstrate an absence of sensitive species on a site-by-site basis. Thus, some sources may be able to avoid compliance

costs if they can demonstrate lack of sensitive species in their locations. However, such a demonstration would likely cost some money.

The Board also proposes to allow compliance schedules longer than 5 years under certain conditions for reissuance of existing permits. These flexibilities would help sources comply with the new criteria to some degree.

Freshwater & Saltwater Cadmium Criteria for Protection of Aquatic Life

In 2016, the EPA updated its 2001 recommended cadmium aquatic life ambient water quality criteria in order to reflect the newest toxicity data for 75 new species and 49 new genera. The Board proposes to adopt the EPA's recommended standard for cadmium. There are four aquatic life criteria (i.e. acute and chronic limits for freshwater and saltwater). The proposed cadmium criteria are more stringent than the current limits by a factor between 1.1 times and 2.2 times. Criteria that are more stringent may mean additional treatment is needed to remove more cadmium before discharging effluent into surface waters. Those permitted treatment plants with monitoring requirements in their permit may also be affected if their discharges have the potential to exceed the proposed criteria.

According to DEQ, there are 24 active discharge permits with either numeric cadmium limits or monitoring requirements. Of these, 10 have effluent limits and 14 have monitoring requirements but no limits. Monitoring requirements without discharge limits typically result from a permit review using a "Reasonable Potential Analysis" that indicates the facility may have a particular parameter in its effluent, ergo the monitoring requirement. The monitoring data is used in subsequent permit reissuances to determine if discharge limits should be included. Given that the cadmium freshwater criteria are becoming more stringent it is assumed facilities with only monitoring requirements may be the most likely to be affected.

Furthermore, the most likely impact expected is for industrial dischargers. However, DEQ has no cost information on retrofits for these types of facilities and each would be unique due to the type of industry, wastewater characteristics and treatment technology used. Thus, there are no available estimates for the potential costs at this time. As far as TMDL costs, there is one aquatic life use impairment near Lake Anna with cadmium listed as the impairment cause, but it has yet to be put on the priority list and as such an active TMDL has yet to be developed. A more stringent cadmium standard may add additional waters to the impaired waters list but DEQ does

not know if that is the case at this time because such determinations are site specific. On the other hand, more stringent cadmium criteria based on latest scientific information will likely provide better protection for aquatic life.

Water Quality Criteria for Protection of Human Health

In 2015, the EPA published water quality criteria for the protection of human health for 94 chemical pollutants. The revisions stemmed from the latest scientific information and the EPA policies, including updated body weight, drinking water consumption rate, fish consumption rate, bioaccumulation factors, health toxicity values, and relative source contributions. Each pollutant has two criteria (i.e. one for public water supply and one for all other waters) for a total of 188 individual criteria concentrations. 57 of these criteria would become less stringent, 127 would become more stringent, 2 would be unchanged, and 2 are new additions and do not have criteria in the current regulation.

Though 127 criteria that are more stringent have the potential to increase compliance costs, according to DEQ, the majority of the human health criteria pollutants tend to be rather exotic compounds and discharger specific. Thus, the potential compliance cost to dischargers is unknown at this time. In addition, it is noted that many of the human health criteria toxins are not monitored routinely unless there is a known or suspected problem. DEQ does not believe there will be additional TMDL designations because of this change but that expectation is uncertain.

Due to anti-backsliding rules, existing permit limits cannot be made less stringent. Thus, 57 less stringent criteria are unlikely to have an effect on current permit limits. However, potential new sources discharging one of these pollutants will be subject to less stringent limits and may avoid installing treatment systems. Thus, new sources may realize some cost savings in potential treatment costs.

127 more stringent and 2 new human health criteria have the potential to help reduce many types of illnesses including cancer. However, some of these rather exotic pollutants may not be present in the Commonwealth's surface waters. If this is the case, no immediate significant impact is likely to be realized, but if any discharge containing these chemicals is discovered, health risks originating from the drinking water and fish consumption may be reduced and the source may have to incur some additional compliance costs.

In short, very few limits are based on human health criteria so no significant impact from the amendments is expected. However, given the large number of human health criteria amendments, it is difficult to determine with certainty at this time what the cost savings or expenses may be.

Bacteria Criteria for Protection of Human Health

The Board proposes to revise the bacteria criteria and assessment methodology for protection of human health. *E. coli* and Enterococci concentrations are used as bacteria indicators for the presence of illness inducing pathogens in fresh- and saltwater respectively.

The aim of the proposed changes is to align Virginia's methodology and criteria with those recommended by EPA, which are expressed in terms of a statistical threshold value (replacing the single sample maximum) and a geometric mean. The current assessment methodology for the single sample maximum allows no more than 10% of the total samples to exceed the criteria over the assessment period that is typically a six-year monitoring database. The proposed statistical threshold value is a similar measure utilized by EPA. Under the proposed regulation, no more than 10% of the total samples may exceed the statistical threshold value using all monitoring data collected up to a 90-day period. Bacteria criteria are also expressed in terms of a geometric mean, which can only be calculated under the current water quality standards using at least 4 observations taken within a 30-day period. The geometric mean standard is a "never-to-be-exceeded" value. Its exceedance puts the water body on the impaired waters list. The intent of the amendment is to switch to a 90-day assessment period to enable the use of more monitoring data, which will maximize the number of monitoring stations that are assessed against both geometric mean and statistical threshold value criteria. The proposed amendment will adopt 2012 EPA recommended statistical threshold values for *E. coli* and Enterococci concentrations and are higher than the current values used for the single sample maximum. The geometric mean concentrations remain unchanged.

The rationale behind the amendment is the proposed bacteria criteria represent the most recent scientific basis for criteria designed to protect primary contact recreational uses. Also, the Federal BEACH Act of 2000 requires that, not later than 36 months after the date of publication by the EPA of new or revised water quality criteria for pathogens or pathogen indicators, each state having coastal recreation waters shall adopt and submit to the EPA new or revised water

quality standards for the coastal recreation waters of the state for all pathogens and pathogen indicators to which the new or revised water quality criteria are applicable. In this case, the most recent EPA criteria were published in 2012.

One of the consequences resulting from these changes is that more waters may be assessed as impaired for the recreational use. Exceedances of the bacteria criteria are the leading cause of TMDL designations; about 80% of existing impairments are due to high bacteria concentrations. There are currently 441 bacteria impairments that are waiting for a development of a TMDL. It is not expected amendments to bacteria criteria will affect dischargers as end-of-pipe limits for bacteria are set at the criterion. However, the number of TMDLs that must be developed may increase.

Businesses and Entities Affected

The proposed amendments particularly affect municipal wastewater treatment facilities and industrial plants that discharge to surface waters of the Commonwealth.

The estimated number of potentially affected facilities due to proposed amendments to the ammonia criteria is 370 (approximately 220 discharge permits issued in the Chesapeake Bay watershed and 150 discharge permits issued outside of the Chesapeake Bay watershed).

According to DEQ, there are 24 active discharge permits with either numeric cadmium limits or monitoring requirements.

The number of potentially effected facilities due to the amended human health criteria and bacteria criteria is not known.

The proposed changes may also affect new and expanded point sources as well as nonpoint sources in the future.

Localities Particularly Affected

The proposed changes apply statewide. Localities with permits that may have to upgrade or install new equipment will be particularly effected.

Projected Impact on Employment

The net impact on employment is not known. A facility requiring an upgrade or monitoring under the proposed regulations will have to hire labor to accomplish those goals.

However, increased costs may also discourage expansion or the building of new plants reducing demand for labor.

Effects on the Use and Value of Private Property

Facilities likely to be affected the most are municipal wastewater treatment facilities. To the extent the proposed more stringent requirements introduce additional compliance costs on privately owned facilities, their asset values should decrease.

The proposed changes also have the potential to affect private property prices through improvements in environmental quality. However, such effects are usually contingent upon noticeable improvements. Since the magnitude of likely effects on environment is not known, no conclusive statements can be made about the effect on the value of private property.

Real Estate Development Costs

The proposed amendments do not directly affect real estate development costs.

Small Businesses:

Definition

Pursuant to § 2.2-4007.04 of the Code of Virginia, small business is defined as “a business entity, including its affiliates, that (i) is independently owned and operated and (ii) employs fewer than 500 full-time employees or has gross annual sales of less than \$6 million.”

Costs and Other Effects

Some of the industrial plants that discharge to surface waters of the Commonwealth will be associated with small businesses. The costs and other effects on them are the same as discussed above.

Alternative Method that Minimizes Adverse Impact

There are no clear alternative methods that would both comply with the Clean Water Act and cost less.

Adverse Impacts:

Businesses:

The adverse impact on businesses is the additional compliance costs discussed above.

Localities:

The adverse impact on localities is the additional compliance costs discussed above.

Other Entities:

The proposed amendments will not adversely affect other entities.

Legal Mandates

General: The Department of Planning and Budget has analyzed the economic impact of this proposed regulation in accordance with § 2.2-4007.04 of the Code of Virginia (Code) and Executive Order Number 17 (2014). Code § 2.2-4007.04 requires that such economic impact analyses determine the public benefits and costs of the proposed amendments. Further the report should include but not be limited to: (1) the projected number of businesses or other entities to whom the proposed regulatory action would apply, (2) the identity of any localities and types of businesses or other entities particularly affected, (3) the projected number of persons and employment positions to be affected, (4) the projected costs to affected businesses or entities to implement or comply with the regulation, and (5) the impact on the use and value of private property.

Adverse impacts: Pursuant to Code § 2.2-4007.04(C): In the event this economic impact analysis reveals that the proposed regulation would have an adverse economic impact on businesses or would impose a significant adverse economic impact on a locality, business, or entity particularly affected, the Department of Planning and Budget shall advise the Joint Commission on Administrative Rules, the House Committee on Appropriations, and the Senate Committee on Finance within the 45-day period.

If the proposed regulatory action may have an adverse effect on small businesses, Code § 2.2-4007.04 requires that such economic impact analyses include: (1) an identification and estimate of the number of small businesses subject to the proposed regulation, (2) the projected reporting, recordkeeping, and other administrative costs required for small businesses to comply with the proposed regulation, including the type of professional skills necessary for preparing required reports and other documents, (3) a statement of the probable effect of the proposed regulation on affected small businesses, and (4) a description of any less intrusive or less costly alternative methods of achieving the purpose of the proposed regulation. Additionally, pursuant to Code § 2.2-4007.1, if there is a finding that a proposed regulation may have an adverse impact on small business, the Joint Commission on Administrative Rules shall be notified.

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